

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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THUIDIUM SCHISTOCALYX (C. Muell.) Mitt. Jour. Linn. Soc. 12: 575. 1869.

Hypnum schistocalyx C. Muell. Syn. 2: 691. 1851.

Plants very similar to *T. minutulum* and readily mistaken for it when sterile; the stem leaves are more distant; the branches are often regularly pinnately branched and frondiform; branch leaves obtusely acute; leaves of branchlets 0.1–0.15 mm. long, oval, *obtusely*; papillae much smaller; *perichaetial leaves ciliate* and *seta rough*. Dade Co., Florida (Small); det. Dr. Best. Although the specimens were sterile there seems no doubt of the determination.

The statement on p. 177, that the paraphyllia are few on the stems of *T. minutulum*, is scarcely correct.

The Florida specimens of *T. schistocalyx* were discovered after pt. 3 was completed. The species will key out to *T. minutulum* in the key on p. 174.

*2. HELODIUM (Sull.) Warnst. Laubm. Krypt.-fl. Mark. Brand. 692. 1905.

Elodium Sull. Mosses U. S. 68. 1856. (As a subgenus).

Plants in deep soft tufts, green to yellowish green, or brownish, especially below; stems mostly simple and erect or nearly so, regularly pinnately branched above (except *H. paludosum*), densely foliate; central strand lacking; branches slender, attenuate; paraphyllia dense, filamentous, freely branched; leaves appressed when dry, erect-spreading when moist, concave with a dorsally projecting plication; costa extending to middle or beyond; leaf cells translucent, elongated-hexagonal to nearly linear, smooth or unipapillate over the lumen or at the upper angle. Autoicous or rarely dioicous; capsule inclined to horizontal, oblong-cylindric, curved; annulus present; peristome perfect hypnaceous, with 3 cilia. Type species, *H. Blandowii*.

KEY.

- Plants very regularly pinnate; costa vanishing above leaf-middle; leaf cells with a large papilla at the distal angle. 1. *Blandowii*.
Plants often irregularly pinnate; costa nearly percurrent, leaf cells with a small papilla at the distal angle or smooth. 2. *paludosum*.

1. HELODIUM BLANDOWII (Web. & Mohr) Warnst. l. c.

Hypnum Blandowii Web. & Mohr, Bot. Taschenb. 332. 1807

Hypnum lanatum Ström, D. Vid. Selsk. Skr. Ny samml. 38 and pl. 11 n. 6 (1791).

Thuidium Blandowii Bry. Eur. fasc. 49–51. 1852.

Thuidium pseudo-abietinum Kindb. Cat. Can. Pl. 7: 285. 1902. (Type seen).

Plants *large*, in dense soft masses, yellow-green to brownish below; stems 5–10 cm. long, erect, rigid, simple or divided, closely and regularly pinnately branched; branches simple, spreading or recurved, attenuate, \pm 1.2 cm. long; stems and branches covered with a tomentum of paraphyllia, long-filamentose from an oblong-linear base; stem leaves 1–1.3 x 0.75–0.9 mm., appressed when dry, ovate-triangular, narrowly acuminate, deeply concave, sulcate, abruptly contracted to a *subclasping decurrent base* bearing paraphyllose appendages; margins entire or sinuate-serrulate, sometimes revolute above; costa vanishing above the middle; median leaf cells oblong-fusiform to linear-rhomboidal, 6–7 μ wide, 3–6 : 1, with a large papilla at the distal end on the dorsal surface, nearly or quite smooth above; basal broader, rectangular, smooth; branch leaves ovate-lanceolate, subcrispate. Monoicous; seta 3–5 cm. long; capsule oblong-cylindric, 3–4 mm. long, curved, nearly horizontal, reddish, strongly contracted and incurved under the mouth when dry and empty; operculum conic-apiculate; inner peristome with 3 cilia; spores in July.

Type locality, Mecklenburg, Germany.

ILLUSTRATIONS:—Bry. Eur. pl. 486; M. H. M. f. 132, pl. 52, f. 4 & 5.

EXSICCATI:—Drum. Musc. Am. 215; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 414; Aust. Musc. Appal. 305; Grout, N. Am. Musc. Pl. 222 and 230. On wet marshy ground in northern N. America from New Jersey, Ohio, Colorado, Idaho and Washington, northwards. Dr. Best in his monograph (Bull. Torr. Bot. Club. vol. 23) remarks that the next is probably a derivative of this and that puzzling intermediate forms occur.

*The Greek-derived *elodes* demands the aspirate in Latin according to classical authorities.

2. *HELODIUM PALUDOSUM* (Sull.) Aust. Musc. Appal. 306. 1870.*Hypnum paludosum* Sull. Musc. Allegh. 7. 1846.*Thuidium paludosum* Rau & Hervey, Cat. 38. 1880.

Plants smaller than in the last; stems 4–6 cm. long, branching usually irregularly pinnate, with branches more irregular in length; paraphyllia much as in the last; stem leaves 1–1.3 mm. long, erect-spreading when moist, plicate-striate, oblong-lanceolate to ovate-lanceolate, narrowed to the scarcely decurrent base which often bears filaments; margins revolute below, sinuate-serrulate above; costa nearly percurrent; median leaf cells oblong to linear-rhomboidal, $\pm 6 \times 45 \mu$, smooth on both surfaces or with a small papilla at the distal end of each cell below, rarely on the upper surface also; branch leaves narrower and smaller, less slenderly acuminate. Monoicous; seta 1.5–3 cm. long; capsule and peristome as in *H. Blandowii*; spores in May.

Type locality, Ohio. Type in the Sullivant collection at the Gray Herbarium of Harvard University.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl.* 101. M. H. M. *pl.* 53; Jennings, Mosses W. Pa. *pl.* 36.

EXSICCATI:—Sull. Musc. Allegh. 7; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 281, (Ed. 2) 415; Aust. Musc. Appal. 306; Grout, N. Am. Musc. Pl. 156.

On the ground in swamps and wet grassy places, New England to Ontario and south to Illinois and North Carolina.

VAR. *HELODIOIDES* (R. & C.) Grout, Ck. List 23, 1929.

Thuidium elodioides R. & C. Hedwigia 32: 251 in separate, 308 in original. 1893.

Often dark green, leaves smaller, leaf cells shorter, more strongly papillose, often on both surfaces with subcentral papillae; margins often dentate-serrate. Type from Indiana (Röll).

Although the type of Kindberg's *Thuidium pseudo-abietinum* is *H. Blandowii*, several other specimens in his herbarium named *pseudo-abietinum* were *H. paludosum*.

Helodium paludosum is exceedingly variable. Some plants are as slender as *Eurhynchium praelongum*, with a percurrent or slightly excurrent costa; others are as stout as *Brachythecium oxycladon*, with leaves of almost the same shape and concavity, bisulcate at base and with short subquadrate alar cells. Some plants are regularly pinnate with shorter branches than *Blandowii*, others are not noticeably pinnate.

3. *CLAPODIUM* (Lesq. & James) R. & C., Musc. Am. Sept. 56. 1893.

Cladopodium Lesq. & James, subgenus of *Hypnum*, Manual, 327. 1884.

Plants small to rather large, resembling *Thuidium* in general appearance; stems creeping, stoloniferous; paraphyllia when present scale-like; stem leaves triangular-lanceolate to broadly ovate, long and narrowly acuminate, margins plane, dentate-serrate (except *C. pellucinerve*), with single strong translucent costa; leaf cells small, round-hexagonal to rhombic, thickened-papillate on both surfaces, making the cells obscure as in *Anomodon*. Dioicous; seta roughened (except *C. pellucinerve*); capsules oblong-ovoid, unsymmetric, inclined to subpendent; annulus present, large; operculum long-conic to -rostrate; peristome perfect hypnaceous, with cilia 1–3; spores smooth.

Distinguished from *Thuidium* by the lack of filamentose paraphyllia and from *Anomodon* by the hypnaceous capsules and peristome. Plants confined to the region of the Rocky Mts. and westward. Type species, *C. Whippleanum*.

KEY.

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|--|--------------------------|
| 1. Plants small; leaves not hair-pointed..... | 1. <i>Whippleanum</i> . |
| Plants mostly larger; leaves hair-pointed..... | 2. |
| 2. Plants largest of the genus; leaf cells with a single large subcentral papilla on each surface..... | 2. <i>crispifolium</i> . |
| Plants smaller; leaf cells with two or more smaller papillae on each surface..... | 3. |
| 3. Stems papillose; seta smooth..... | 4. <i>pellucinerve</i> . |
| Stems smooth except below basal leaf angles; seta rough..... | 3. <i>Bolanderi</i> . |

1. *CLAPODIUM WHIPPLEANUM* (Sull.) R. & C., l. c.

Hypnum Whippleanum Sull. Pacific R. R. Rep. 4: 190. 1856.

Thuidium leskeoides Kindb. Bull. Torr. Bot. Club. 17: 277. 1900.

Plants in rather thin spreading mats, deep to dark green; stems 2-4 cm. long, creeping, stoloniferous, sometimes flagellate, irregularly pinnately branched; stem leaves ± 1 mm. in length, ovate-lanceolate to lanceolate, gradually narrowly long-acuminate, slightly decurrent; margins plane, dentate below, sharply serrate above; costa subpercurrent; lower leaf cells oblong-rectangular to linear-rhomboidal, irregularly quadrate-oblong at basal angles; median indistinctly rhombic to irregular, $6-7 \mu$ wide, for the most part distinctly longer than broad, often 2:1, all except the very lowest with one or more large papillae on each surface; marginal elongated, curvilinear, usually without chlorophyll, paraphyllia few or lacking; branch leaves smaller and shorter acuminate, those of the terminal branches more or less complanate, loosely spreading, rather irregularly contorted when dry. Seta rough, ± 1 cm. long; capsule oblong-ovoid, horizontal, subpendent and contracted under the mouth when dry and empty; operculum conic, short-rostrate, urn 1.5-2 mm. long, 1.5-2:1; operculum ± 1 mm. long; spores in spring.

Type locality, California. Type in the Sullivant Collection at Harvard University.

ILLUSTRATIONS:—Sull. l. c. *pl. 9* (in part); *Pl. 46B*.

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 2) 407; Grout, *N. Am. Musc. Pl.* 131.

On rocks and banks, especially on shaded soil at base of trees and cliffs. California to Vancouver Island. "Rudimentary leaves, nearly destitute of papillae, with leaf cells linear-rhomboidal and costa vanishing in the middle, are not infrequent on stolons and flagella." Best *Bull. Torr. Bot. Club*, 24: 429.

Var. *LEUCONEURUM* (Sull. & Lesq.) n. comb.

Thuidium leuconeurum Sull. & Lesq. in Sull. *Icones Musc. Suppl.* 104, *pl. 80*. 1874.

Clao podium leuconeurum R. & C. *Musc. Am.* Sept. 50. 1892.

In compact spreading tufts; stems 2-3 cm. long; branches often subjulaceous with appressed leaves; none of the leaves two-ranked, lanceolate to ovate-lanceolate, all as a rule less slenderly acuminate than in the species; seta minutely roughened to smooth, capsules small, ovoid; operculum long-conic to rostrate.

Apparently a reduced xerophytic form, intergrading and often intermingled with the species.* Type locality California. Type in Sullivant Collection.

ILLUSTRATIONS:—Sull. l. c. & Pacific R. R. Rep. 4: *pl. 9* (in part); Sull. l. c.; 46A.

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 2) 407b; Grout, *N. Am. Musci Pl.* 377.

San Diego, California (MacFadden) to Washington (Foster).

2. CLAOPODIUM CRISPIFOLIUM (Hook.) R. & C., *Musc. Am.* Sept. 50. 1892.

Hypnum crispifolium Hook. *Musc. Exot.* 1: *pl. 31*. 1818.

Hypnum ramulosum Hampe in Muell. *Syn. Musc.* 2: 486. 1851.

In intertangled spreading mats, yellow-green above, reddish-brown below; stems 5-8 cm. long, irregularly divided, closely and rather regularly pinnately branched, not papillose; branches attenuate; paraphyllia few, serrate; stem leaves close, when dry crispate-incurved, when moist erect-spreading, incurved, reaching 1.8×0.7 mm. from a broadly ovate, auriculate subclasping decurrent base, abruptly contracted to a long linear-lanceolate acumination, considerably longer than the basal portion and ending in a long, more or less serrate, hyaline point; margins serrate-dentate to undulate-rugose; costa narrow, extending well into the acumination; median leaf cells small, 6μ wide, short-oblong to rounded-quadrate, with a single large papilla on each face near the center; the basal-central clear, oblong-linear to rounded-rectangular, the very lowest smooth, incrassate and somewhat porose; upper marginal cells elongated; branch leaves smaller, lanceolate to ovate-lanceolate, rather gradually narrowed to the much shorter hair point. Seta 2.5-3 cm. long, very rough; capsules oblong-ovoid, inclined to horizontal; urn 2.5-3 mm. long; operculum long-rostrate; reaching 2 mm. in length; annulus large, deciduous; spores winter to early spring.

Type locality, west coast of North America, Menzies. Type in Hooker Herbarium at Kew.

ILLUSTRATIONS:—Hook. l. c.; Schwaegr. *Suppl.* 2: *pl. 143*; *Pl. 45*.

EXSICCATI:—Grout, *N. Am. Musci Pl.* 70 & 70a; Allen, *Mosses Cascade Mts.* 92.

On ledges, stones and soil. From California northwards, east to Idaho. The collections reported from Colorado by the author are *Helodium Blandowii*, which this species much resembles in gross appearance, but is otherwise quite unlike.

*See Dr. Best's remarks l. c. pp. 429 & 430.

An interesting fact is that a specimen collected at Mt. Tamalpais, Marin Co., California, April 17, 1893 by Dr. M. A. Howe and determined by him as *Hypnum leuconeurum* was later determined by Dr. Best as *C. Whippleanum*. So far as the author can determine, the plants have the subjulaceous branches and the short capsules of var. *leuconeurum* and at least one seta is entirely smooth but in some of the shorter capsules (about 1 mm. long) the operculum is nearly as long as the urn!

3. *CLAOPODIUM BOLANDERI* Best, Bull. Torr. Bot. Club. 24: 431. 1897.

The plants have much the appearance of the last but are a little smaller and more slender, the stems may reach an equal length and the leaves are nearly or quite equal in length. The ovate leaf base is relatively shorter and more abruptly contracted to the acumination; *the leaf cells are indistinct, with 2-5 small papillae* on each surface; the median cells of stem leaves are more evenly rounded-quadrate with diameter about 6μ ; the pellucid cells of the basal-central area are shorter and fewer, the lowest without papillae; the marginal cells of acumination are somewhat larger but scarcely twice as long as broad. Capsules a little smaller, urn about 2 mm. long and conic-rostrate operculum about 1.5 mm. long; cilia of peristome often poorly developed; spores autumn to winter.

Type locality, Marin Co., California (Bolander). Type in herbarium of Columbia University. Pl. 45.

Habitat and range the same as with the last; Alaska. Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 405; (Det. Best).

A well marked and distinct species in spite of its many resemblances to the last. Dr. Best says (l. c. 432) the leaves are not as abruptly contracted to the acumination, with which opinion the author differs.

Brotherus [Engler & Prantl, Musci (Ed. 2) 2: 317] says the stems are papillose; he is surely in error. The author has never found any such. Occasionally a bit of the decurrent leaf base may make the stem appear papillose.

4. *CLAOPODIUM PELLUCINERVE* (Mitt.) Best, Bryol. 3: 19. 1900.

Leskea pellucinervis Mitt. Musc. Ind. Or. 130. 1859.

Plants dark green, more slender than the last two as a rule; *stems and larger branches minutely papillose*; stem leaves ovate-lanceolate to elongated-triangular, rather gradually narrowed to a subhyaline hair-like point shorter than in either of the last two, ± 1 mm. long, cordate and decurrent at base,* occasionally slightly serrulate at apex; costa much as in the last two, papillose; median leaf cells oval-rhombic to oblong-hexagonal, about 6μ wide, covered on both sides with small papillae more numerous than on the last: very few cells of the basal-central area somewhat larger, pellucid, papillose to the very base; marginal little or not at all differentiated. Mitten says the capsules are exactly like those of *C. Whippleanum* and Brotherus says the seta is smooth. Type locality, Simla, North India. Type in the Mitten Herbarium at the New York Botanical Garden. Pl. 45.

On rocks; Yukon Terr. (Williams); New Mexico (Standley, det. Best).

4. *HETEROCLADIUM* Bry. Eur. fasc. 49-51. 1852.

Plants medium-sized to rather small and slender; primary stems rigid, creeping, more or less stoloniform, sparingly paraphyllose; secondary stems with irregular, often flagelliform branches; leaves more or less papillose (smooth in *H. procurrens*); stem leaves triangular-ovate, cordate, subclasping, narrowly acuminate; branch leaves smaller, narrower, ovate to ovate-lanceolate, obtuse, acute or short-acuminate; costa short, double or forking, less frequently single and reaching the leaf middle. Dioicous; setae smooth; capsules inclined to horizontal, curved; annulus present; peristome perfect hypnaceous; basal membrane of inner peristome $\frac{1}{4}$ - $\frac{1}{2}$ height of teeth; operculum conic to rostrate.

Type species *H. heteropterum*.

Dr. Best in his monograph, Bull. Torr. Bot. Club. 28: 123-131. 1901. says: "The short, thin, usually broad costa and the elongated, circumscribed leaf cells of the basal-central area separate the members of this genus from the closely related *Thuidia*." The poorly developed costa also distinguishes this genus from the other genera of the Leskeaceae with which it is at all likely to be confused.

KEY.

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|---|--------------------------|
| 1. Stem leaves smooth..... | 1. <i>procurrens</i> . |
| Stem leaves more or less papillose..... | 2. |
| 2. Apical cells of ultimate branch leaves smooth or with a single papilla..... | 3. |
| Apical cells of ultimate branch leaves with at least 2 papillae..... | 4. |
| 3. Branch leaves rounded-obtuse to subacute; leaf cells with a single papilla; operculum conic..... | 2. <i>squarrosulum</i> . |
| Branch leaves acute to acuminate; leaf cells often with 2 papillae; operculum rostrate..... | 5. <i>heteropterum</i> . |

*Brotherus [Engler & Prantl, Musci (Ed. 2) 2: 318] states that the leaves are not decurrent.

4. Leaves of secondary stems acuminate, cells of ultimate branch leaves with 2-5 papillae..... 3. *heteropteroides*.
Leaves of secondary stems slenderly long-acuminate; leaf cells with 1-3 papillae. 4. *Macounii*.

1. HETEROCLADIUM PROCURRENS (Mitt.) Rau & Hervey, Cat. 38. 1880.

Pterogonium procurrens Mitt. Journ. Linn. Soc. 8: 37. pl. 7. 1865.

Heterocladium aberrans R. & C. Bot. Gaz. 15: 59. 1890.

Plants rather stout for the genus, in spreading tufts, pale to yellowish green; stems 4-8 cm. long, stoloniform, pinnately branched; smaller branches simple, attenuate; larger branches often closely pinnate; central strand present; paraphyllia few, linear-lanceolate, serrate; stem leaves scarious, distant, spreading-recurved wet or dry, 1.4-1.8 x 0.6-0.9 mm., broadly triangular-ovate from an auriculo-cordate subclasping base, abruptly filiform-acuminate, acumination as long as base of leaf; costa thin, forking, the longer branch disappearing about or below the leaf middle; larger branch leaves similar, not auriculate, subdistichous, spreading, gradually acute to narrowly acuminate; margins crenate-serrate; costa longer and more strongly serrate at back, usually acute to narrowly acuminate; smaller branch leaves ovate-lanceolate, lower acute, upper sometimes obtuse; upper cells of very young branch leaves slightly papillose at back; cells of stem leaves smooth, clear, multiform, those of the median basal area linear, obtuse, $\pm 6 \mu$ wide, 4-6 : 1, the others broader and shorter, varying from oblong-fusiform to oval-rhombic; apical cells linear; median cells of branch leaves broader and shorter. Setae about 2 cm. long; capsules reddish brown, oblong-ovoid, horizontal, curved and contracted under the mouth when dry and empty; urn 1.5-2 mm. long, about 2 : 1; operculum conic, apiculate; spores in February. Type locality British N. America, Drummond. Type in Mitten Herbarium at the New York Botanical Garden.

ILLUSTRATIONS:—Mitten, l. c.; Best, l. c. pl. 13; Pl. 48.

EXSICCATI:—R. & C. Musc. Am. Sept. 94 (as *H. aberrans*); Macoun, Can. Musci 498 & 690, also 484 & 692 (as *H. homoeopterum*); Grout, N. Am. Musci Pl. 75; Allen, Mosses Cascade Mts. 89; Holzinger and Blake, Plants of N. W. Montana 47.

On rocks, soil and occasionally on roots of trees. Montana, Idaho, Washington and British Columbia. Dr. Best, whose monograph is followed in the main, says "spores in June," but Allen's 89 collected in Feb. has perfect capsules, while specimens collected in June are deoperculate. In some cases the leaves become erect-spreading when dried.

2. HETEROCLADIUM SQUARROSULUM (Voit) Lindb. Musc. Scand. 37. 1879.

Hypnum squarrosulum Voit in Sturm, Deutschl. Flora 2: fasc. 11. 1810.

Hypnum dimorphum Brid. Sp. Musc. 2: 149. 1812.

Plants more slender than the last, in thin spreading tufts, pale to deep green; primary stems 3-6 cm. long, with rudimentary central strand, stoloniform, irregularly divided and branched; secondary stems irregularly branched or occasionally almost regularly pinnate; paraphyllia multiform, few, roundish ovate to narrowly lanceolate, serrate; leaves of primary stems variable, the lower often rudimentary, the upper obscurely two-ranked, papillose, 0.7-1 x 0.5-0.7 mm., from a decurrent, cordate subclasping base broadly round-ovate, abruptly subfiliform acuminate, with upper part of leaf spreading-recurved; margins plane, crenulate-serrulate; costa usually short, thin, divided or double, sometimes obsolete, rarely reaching nearly to leaf middle; leaves of secondary stems loosely appressed-imbricate when dry, erect-spreading when moist, broadly ovate, serrulate, obtuse to short-acuminate; *ultimate branch leaves roundish ovate, rounded-obtuse to subacute*; leaf cells of the basal-central area of leaves of primary stems nearly smooth, clear, linear-oblong, about 6μ wide, 3-6 : 1, in some cases this type of cell passes through the middle of the leaf into the acumination, in others they are surrounded above as well as on the sides by a broad border of shorter cells, varying from roundish quadrate to oval-oblong, *with a single (usually) subcentral papilla on both surfaces*; leaf cells of the branch leaves similar, those of the basal-central area shorter, the border cells sometimes hexagonal-quadrate. Seta about 1.5 cm. long; capsule constricted below the mouth when dry and empty, urn about 1.5 mm. long, about 2 : 1; operculum conic; spores in late winter or early spring. Type locality, Schweinfurt, Germany.

ILLUSTRATIONS:—Best l. c. pl. 13; Pl. 48.

EXSICCATI:—Macoun, Can. Musci 660 & 687 (as *dimorphum*); Grout, N. Am. Musci. Pl. 405, & 169 (as *Thuidium microphyllum*).

On rocks, soil and roots of trees from southern Vermont to Greenland, westward to Montana, Idaho, Washington and British Columbia. It has been reported from the vicinity of Amherst, Massachusetts in several lists but it is possible that all these records are based on Frost's report of a specimen from Brattleboro, Vermont in the Tuckerman and Frost List of plants growing in the vicinity of Amherst.

Dr. Best remarks in his monograph that this species varies considerably according to differences in habitat. When on rocks at high altitudes the tufts are more compact, the secondary stems and branches subulaceous and the leaves more obtuse.

Var. *COMPACTUM* Mol. in sched., Pfeffer, Bryogr. Stud. *pl.* 71. 1869.

In dense grayish green tufts; primary stems stoloniferous with rudimentary leaves, not rarely defoliate; secondary stems ascending-erect, closely branched, branches short, obtuse, terete; leaves when dry appressed-imbricate, round-obtuse, nearly entire. Type locality, European.

On exposed rocks at high altitudes, Leiberg, Mosses from Kootenai Co., Idaho, no. 175, also Slocan City, British Columbia, Mrs. MacFadden.

3. *HETEROCLADIUM HETEROPTEROIDES* Best, l.c. 128.

Plants very slender, in intricate spreading tufts or mats, dark green; primary stems without central strand, creeping, stoloniferous, 3-6 cm. long, variously divided and irregularly branched; secondary stems ascending, irregularly branched to nearly regularly pinnate; all stems papillose; paraphyllia present, foliose to linear; leaves of creeping primary stems appressed-open, with reflexed or spreading apices, triangular-ovate from a subclasping cordate base, slenderly acuminate, 0.4-0.5 mm. long, papillose; margins plane, finely denticulate; costa thin, usually short and double; leaves of secondary stems, larger, more broadly ovate as a rule, more strongly costate and more strongly papillose, often as slenderly acuminate as figured for *H. Macounii*; ultimate branch leaves ovate, acute to narrowly acuminate; *cells of the basal-central area of stem leaves not so clearly differentiated as in the preceding species*, oblong to sublinear, $\pm 6 \mu$ wide, 2-4 : 1, incrassate, those of the basal margins, rounded quadrate, passing into oval-oblong above, often broader than long, *each cell with 2-5 small bead-like papillae on each surface; apical cells of ultimate branch leaves quadrate to oblong, crowned with 2-4 papillae*. Setae about 1.5 cm. long; capsules ovoid, contracted under the mouth when dry and empty; urn 1.5 mm. long, 2 : 1; *operculum conic-rostrate*, nearly as long as the urn; spores in summer to autumn. Type locality, Washington. Type collected by J. A. Allen in the upper Nesqually Valley, Oct. 4, 1898.

ILLUSTRATIONS:—Best, l.c. *pl.* 14: *Pl.* 47.

EXSICCATI:—Macoun, Can. Musci 267 and 108 (as *H. heteropterum*).

On stones and ledges in damp places, Idaho, Oregon, Vancouver Id. & British Columbia.

Spores seem to be rarely produced. Distinguished from the closely related *H. heteropterum* by the apical cells of the ultimate branch leaves crowned with 2 or more papillae instead of one.

Var. *FILESCENS* Best, l. c.

Dark to yellowish green; primary stems creeping, 8-10 cm. long, sparingly branched; stems and branches filiform; leaves smaller, those of primary stems often almost scale-like. Type of variety collected W. B. Whittmeyer in the canyon of the Stilliquamish River, Washington, June, 1892. The variety seems even more common than the specific type and often associated with it and developed from it by habitat conditions. Grout, N. Am. Musci Pl. 69 merges into this variety.

EXSICCATI:—Macoun, Can. Musci 688 (as *H. heteropterum*); Grout, N. Am. Musci Pl. 250 & 473; Allen, Mosses Cascade Mts. 90a (as the species).

This variety strongly resembles *Tripterocladium* in gross appearance.

Most of the specimens in my herbarium seem intermediate between the species and variety.

H. heteropteroides and *H. procurrens* are often intermingled and *Hypnum occidentale* Sull. & Lesq. is often found with the former.

The costa in the species is often rather stout and reaches the leaf middle.

*4. *HETEROCLADIUM MACOUNII* Best, l. c. 127. *pl.* 14.

Scarcely more than a variety of the preceding from which it differs as follows: plants somewhat more robust throughout, leaves noticeably secund; stems and branches curved at the ends; all leaves more slender-pointed, especially the slenderly acuminate leaves of the secondary stems; papillae of the leaf cells rarely more than 3. Type locality, Vancouver Island; collected by John Macoun, June 2, 1893, and distributed

as *H. vancouveriense* Kindb., Can. Musci 638. Type in the herbarium of the New York Botanical Garden. Pl. 47.

Collected at several points on Vancouver Id. and at Cathlamet, Washington by A. S. Foster; Ashford, Washington, Allen.

5. *HETEROCLADIUM HETEROPTERUM* (Bruch.) Bry. Eur. fasc. 49-51, pl. 480. 1852.

Pterogonium heteropterum Bruch in Schwaegr. Suppl. 3¹: pl. 210b. 1827.

A European species likely to be found in North America. It resembles the last but is easily distinguished by its non-secund leaves, non-papillose stems, and apical cells of ultimate branch leaves crowned with a single papilla. There are rarely, if ever, more than two papillae on one surface of a leaf cell. All known plants from N. America purporting to be this species have proved to be something else.

Subfamily LESKEAE.

Mostly slender plants, loosely to densely tufted; variously, but mainly irregularly, branched; central strand lacking or rudimentary; paraphyllia often present; leaves ovate to ovate-lanceolate, mostly papillose; costa strong (except in *Pterigynandrum*), usually reaching the leaf middle or beyond. Capsules erect and symmetric, or slightly inclined and somewhat curved; cilia of inner peristome short, rudimentary or wanting; operculum conic to short-rostrate.

5. **PSEUDOLESKEA* Bryol. Eur. fasc. 49-51. 1852 (in part).

Lescuraea Bryol. Eur. fasc. 46-49. 1851.

Plants small to medium size, growing on rocks, stones, bases of trees, rarely on rotten wood or on the ground, generally in mountainous regions; stems radiculose, pinnately branched, central strand none or rudimentary; branches simple, usually recurved at tips; paraphyllia numerous, mostly linear-lanceolate; leaves papillose to smooth, entire to serrulate above, biplicate, ovate-lanceolate, acuminate, costate, margins often recurved; leaf cells quadrate-hexagonal to linear-rhomboidal; capsules erect or inclined, straight or curved, thick-walled, air spaces none, stomata few at the base and functionless; *exothecial cells usually quadrate*; exostome well developed, teeth confluent at the base into a colored basal band of the same texture; basal membrane $\frac{1}{6}$ to $\frac{1}{3}$ the length of the teeth; cilia usually poorly developed; calyptra cucullate.

KEY.

- | | |
|---|------------------------|
| 1. Median cells of stem-leaves usually not much more than twice as long as wide..... | 2. |
| Median cells of stem-leaves three or four times as long as wide, or longer..... | 5. |
| 2. Leaves papillose on both surfaces..... | 1. <i>atrovirens</i> . |
| Leaves smooth or papillose only on the upper surfaces..... | 3. |
| 3. Leaves entire, smooth; paraphyllia rarely present..... | 4. <i>arizonae</i> . |
| Leaves often serrulate, papillose to almost smooth; paraphyllia present, sometimes few and small..... | 4. |
| 4. Leaves long-acuminate..... | 2. <i>oligoclada</i> . |
| Leaves acute to short-acuminate..... | 3. <i>pallida</i> . |
| 5. Many leaves with pale, slender hair-points..... | 8. <i>Baileyi</i> . |
| Leaves without such hair-points..... | 6. |
| 6. Plants robust, often 6-10 cm. long, sparingly branched..... | 5. <i>denudata</i> . |
| Plants seldom more than 4 cm. long, more frequently branched..... | 7. |
| 7. Costa percurrent in some of the leaves..... | 8. |
| Costa never more than subpercurrent..... | 9. |

* Grateful acknowledgment is made of the work of Dr. G. N. Best (Bull. Torr. Bot. Club 27: 221-236. 1900, and Bull. Torr. Bot. Club 30: 463-482. 1903), from whose monographs the writer has freely drawn in revising this and the following genus. Such corrections and additions as were necessary have been made. For assistance in various ways the author is also indebted to Dr. A. J. Grout, Newfane, Vt.; Mr. E. B. Bartram, Bushkill, Pa.; Mr. R. S. Williams, New York Botanical Garden; Mr. P. M. Hurlbert, National Museum of Canada, and Mr. C. L. Porter of the Rocky Mountain Herbarium, Laramie, Wyoming. Aaron J. Sharp, Univ. of Tennessee, Jan. 1934.

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|---|-----------------------|
| 8. Leaves often strongly papillose; basal cells oblong..... | 7. <i>atricha</i> . |
| Leaves smooth or lightly papillose; basal cells oblong-linear..... | 10. <i>frigida</i> . |
| 9. Paraphyllia rarely present..... | 4. <i>arizonae</i> . |
| Paraphyllia always present..... | 10. |
| 10. Leaf acumen short and broad; paraphyllia large and multiform..... | 6. <i>radicosa</i> . |
| Leaf acumen longer and narrower; paraphyllia small..... | 9. <i>rigescens</i> . |

1. *PSEUDOLESKEA ATROVIRENS* [Dicks.] Bryol. Eur. 5: pl. 477. 1852.

Hypnum atrovirens Dicks. Pl. Crypt. fasc. 2. 10. 1790.

Leskea ? patens Lindb. Act. Soc. pro Fauna et Flora Fenn. 1880.

Pseudoleskea ticinensis Bott. Proc. Soc. Tosc. Sc. Nat. 1891.

Pseudoleskea atrovirens, var. *patens* (Lindb.) Hagen in sched. 1894.

Pseudoleskea heterocladioides Kindb. Rev. Bryol. 22: 83. 1895.

Pseudoleskea tenella Kindb. Eur. & N. Am. Bryin. 50. 1896.

Plants loosely spreading, dark green above, reddish brown below; stems 3–5 cm. long, prostrate or slightly ascending, radiculose, branched sparingly below and irregularly pinnately above; branches simple, unequal, straight or curved; paraphyllia linear-lanceolate; stem leaves asymmetric, appressed-incurved when dry, erect-spreading when moist, the lower sometimes slightly recurved, entire or serrate above, gradually acute to somewhat abruptly acuminate from an ovate or oblong-ovate subdecurrent base, sharply and obliquely pointed, straight or subsecund, lightly biplicate, costate into the acumen, 0.8–1.2 mm. long, 0.4–0.6 mm. wide; margins recurved below and often at the base of the acumen; cells of the stem leaves nearly isodiametric, incrassate, chlorophyllose, *unipapillate on both surfaces*; papillae central, conic on the upper surface, round and flat on the lower; median cells quadrate-hexagonal, rarely more elongated, 7–9 μ wide; basal cells quadrate in several rows; apical cells oval-oblong; inner perichaetial bracts whitish, loosely erect, narrowly acuminate, lightly costate. Dioicous; seta reddish brown, smooth, 8–10 mm. long, slightly curved; capsule inclined to horizontal, broadly ovoid, asymmetric; exothecial cells roundish-quadrate, thick-walled; urn 1.5 mm. long, 0.8 mm. wide, constricted when empty and dry; teeth yellowish brown, margined, confluent into a purplish red basal band 5 lamellae wide; lamellae numerous, well developed; basal membrane yellowish, papillose, $\frac{1}{4}$ – $\frac{1}{2}$ the length of the teeth; segments as long as the teeth, often slightly open on the keel; cilia one or two, poorly developed; annulus narrow; spores rough, 12–16 μ , maturing in spring. Type locality uncertain but probably Scotland.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: pl. 7, figs. 1–7. 1900; Pl. 53.

EXSICCATI:—Ren. & Card. Musc. Amer. Sept. 92; Husnot, Musc. Gall. 343.

On rocks, rarely on the bases of trees or the ground, Newfoundland and Labrador to British Columbia and southward to California, Idaho and New Hampshire.

In regard to European material, see Best's notes (Bull. Torr. Bot. Club 27: 225, 226. 1900).

2. *PSEUDOLESKEA OLIGOCLADA* Kindb. Bull. Torr. Bot. Club 17: 277. 1890.

Plants in rigid spreading tufts, yellowish green to reddish brown, usually with a glassy lustre; stems 3–6 cm. long, prostrate to slightly ascending, curved at the tips; branches few, unequal, subulaceous, recurved; paraphyllia numerous, lanceolate; stem leaves close, appressed when dry, erect-spreading when moist, falcate-secund, biplicate, rather gradually narrowed into a long serrulate or entire acumen from an oblong-ovate subdecurrent base, 1.2–1.5 mm. long, 0.45–0.6 mm. wide; margins more or less recurved; costa very distinct, toothed on the lower surface, disappearing in the acumen; cells of stem-leaves *not uniform*, rather small and compact, with rounded-obtuse ends; median cells smooth on the lower surface, *lightly unipapillate on the upper, or often smooth on both*, oval-rhombic to linear-oblong, 6–8 μ wide, 2 to 3 times as long; basal cells quadrate-oblong to sublinear; alar transversely oval, becoming rounded-quadrate and extending well up the margins; apical small, oval to oval-oblong, branch leaves falcate, more distinctly serrulate, scarcely plicate; inner perichaetial bracts whitish, erect, long and narrowly subfiliform acuminate, distantly toothed or entire, lightly costate; cells long-linear, subflexuose. Dioicous; seta 9–11 mm. long, more or less curved; capsule oval-oblong, subsymmetric, reddish-brown, from almost erect to subcernuous; exothecial cells roundish oblong-quadrate; teeth reddish brown, joined at base into a band 5 joints wide; lamellae numerous, prominent; basal membrane yellowish, scarcely papillose, $\frac{1}{4}$ – $\frac{1}{2}$ the length of the teeth; segments narrower than, but as long as, the teeth, open on the keel; cilia one or two, more or less developed;

annulus narrow, indistinct; operculum conical; spores roughened, 14–16 μ , maturing in spring. Type locality, Vancouver Island, collected by Prof. John Macoun, June 8, 1887.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: pl. 7. figs. 8–14, pl. 8. figs. 25–27. 1900; Pl. 53.

EXSICCATI:—Grout, N. Am. Musc. Pl. 472, 472a.

On rocks in the mountains, British Columbia to Colorado and Utah.

This species is to be distinguished from *P. atrovirens* by the longer acumen and polymorphous leaf cells which are at most only slightly papillose on the upper surface. It is more rigid and has smaller leaf cells than *P. radicata*.

3. PSEUDOLESKEA PALLIDA Best, Bull. Torr. Bot. Club 27: 227, 228. pl. 7. figs. 16–21. 1900.

Plants in dense flattened tufts, pale olive-green above, ferruginous below; primary stems prostrate, defoliate; secondary prostrate-ascending, 2–4 cm. long, sparingly branched above; branches straight or curved at tip, diverging very slightly; *paraphyllia* few, small; stem leaves asymmetric, deeply concave, biplicate, straight or slightly secund, gradually acute to abruptly short-acuminate from a roundish ovate base, often serrulate, 0.7–0.9 mm. long, 0.4–0.5 mm. wide; costa weak, subpercurrent; cells of stem leaves scarcely papillose, almost clear; basal cells short, rectangular; alar quadrate to transversely oval; median rhombic-oval to hexagonal-oblong, 7–9 μ wide, about twice as long; apical oval-oblong; perichaetial bracts erect, entire or serrulate, inner lightly costate. Dioicous; seta 8 mm. long, curved; capsule nearly symmetric, oval-oblong, inclined; urn 1.5 mm. long, .8 mm. wide; teeth yellowish, confluent at base into a reddish basal band 3–4 joints wide; basal membrane yellow, $\frac{1}{4}$ the length of the teeth; segments as long as the teeth, slightly open; cilia 2, rudimentary; spores rough, 13–16 μ . Type locality, Colorado; collected by T. S. Brandegee; type in herb. Columbia Univ.

ILLUSTRATIONS:—Best, l. c.; Pl. 53.

EXSICCATI:—Bauer, Musc. Eur. et Am. 2183.

Rare, in the mountains, Montana to Colorado.

Var. FILESCENS Best, l. c.

This differs from the type in having filiform secondary stems with few or no branches, leaves narrower (0.3–0.4 mm. by 0.6–0.8 mm.), with longer and narrower cells, and perichaetial bracts almost ecostate.

Type locality, Colorado; collected by T. S. Brandegee.

4. PSEUDOLESKEA ARIZONAE R. S. Williams, Bryologist 33: 20. pl. 3. 1930.

Pseudoleskea integrifolia Dixon & Bartram in litt.

Plants small, in flattened tufts, pale to olive-green above, brownish below; stems slender, procumbent, 2–3 cm. long, irregularly branched, with a rather distinct rudimentary strand; *paraphyllia* rare; stem leaves entire, rather broadly ovate-acute, reflexed on the margin often from near apex to base, about 0.3 mm. wide and 0.6 mm. long; costa stout, prominent, smooth on the back, $\frac{3}{4}$ the length of the leaf; leaf cells smooth, irregular, mostly elongate; median often rhombic, 2–4 μ wide, 5–10 μ long; alar quadrate to transversely elongated, in 2–3 rows; perichaetial bracts pale, entire, plicate, mostly costate, up to 1.4 mm. long. Dioicous; seta red, smooth, at least 1 cm. long; capsule slightly curved-ovate, inclined; urn 1 mm. long, 0.5 mm. wide; teeth hyaline-bordered, finely cross-striate below, papillose above, confluent at base; basal membrane $\frac{1}{3}$ – $\frac{1}{2}$ the length of the teeth, papillose; segments nearly as long as the teeth, narrowly lanceolate, finely papillose, often slightly open on the keel; cilia one or two, nearly as long as the segments, slender, papillose; annulus frequently broad and well developed; operculum conical-acute; spores smooth or slightly granulose, 11–15 μ . Type locality, Monument Peak, Chiricahua Mts., Ariz.; collected by J. C. Bloomer, Oct. 2, 1908; type in herb. N. Y. Botanical Garden.

ILLUSTRATIONS:—Williams, l. c.; Pl. 55.

EXSICCATI:—Grout, N. Am. Musc. Pl. 412 (as *P. pallida*); Bartram, Mosses of S. Ariz. 35, 359, 390A, 396, 403B and 406.

Rather common in the mountains of the arid southwest.

While this species is clearly allied to *P. pallida* and particularly to *P. oligoclada*, it is distinct from both in the entire leaf margin, the smooth costa, the scarcity of paraphyllia and the well-developed cilia of the inner peristome.

5. *PSEUDOLESKEA DENUDATA* Kindb. Eur. & N. Am. Bryin. 52. 1897.

Pseudoleskea sciuroides, var. *denudata* Kindb.; Macoun, Cat. Can. Plants 6: 181. 1892.

? *Ptychodium oligocladum* Limpr. Die Laubm. 2: 801. 1895.

Plants in loose spreading tufts, pale yellow-green above, brownish to dirty white below; stems with very few branches, not radiculose, prostrate, serpentine, 6–10 cm. long, defoliate below; stems and branches hooked at tips; *paraphyllia* multiform, mostly long and narrowly linear lanceolate; upper stem leaves appressed when dry, erect-spreading when moist, concave, more or less falcate-secund, lightly plicate; ovate-lanceolate from a decurrent base, acuminate, narrowly and obliquely pointed, entire or serrulate above, 1.9–2.2 mm. long, 0.7–0.9 mm. wide; margins broadly recurved to apex; costa narrow, yellowish, subpercurrent; cells of stem leaves yellowish at base, smooth, clear; median cells sublinear, flexuose, 5–7 μ wide, 4–6 times as long; basal oblong-rectangular; alar quadrate-oblong; apical linear; branch leaves much smaller, distinctly serrulate above. Dioicous; sporophyte unknown. Type locality, Asulkan Creek, Selkirk Mts., Canada, collected by J. Macoun, Aug. 7, 1890; type duplicate in herb. Can. Geol. Survey.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: pl. 7, figs. 22–27. 1900; Pl. 53.

EXSICCATI:—Grout, N. Am. Musc. Pl. 455.

Rarely collected; on soil and rocks, British Columbia.

This is one of the largest known species of *Pseudoleskea* and both it and the following variety may be recognized by their size and freedom from radicles. The sporophyte of the species probably resembles that of the following variety. Concerning the latter, the well-developed cilia are of interest.

Var. *HOLZINGERI* Best, Bull. Torr. Bot. Club 27: 229. pl. 8, figs. 28 & 29. 1900.

The gametophyte differs from the type in its shorter and diffusely branched stems with leaves slightly smaller and more strongly falcate-secund; perichaetial bracts small, thin, broadly ovate-oblong, abruptly and narrowly acuminate, serrulate above, tips spreading-recurved, inner subvaginate, costate; seta reddish brown, slightly curved, flattened and twisted above, 10–12 mm. long; capsules broadly oblong-oval, asymmetric, inclined, strongly contracted when dry and empty; urn 1.5–2 mm. long, 1 mm. wide; exothelial cells thick-walled; teeth reddish brown, strongly lamellate, confluent into a purplish red basal band 4 joints wide; basal membrane yellow, papillose, $\frac{1}{4}$ – $\frac{1}{2}$ the length of the teeth; segments as long as the teeth, carinate, open; cilia 1–3, rather well developed, papillose; annulus narrow; operculum short-conic; spores rough, 16–20 μ , maturing in spring.

ILLUSTRATIONS:—Best, l. c.; Pl. 53.

EXSICCATI:—Allen, Mosses of the Cascade Mts. 95; Bauer, Musc. Eur. et Am. 2181 & 2182.

Rather more common and more widely distributed than the type. On soil and rocks, British Columbia, Montana, Hudson Straits. This variety can be separated from *P. radicata* by its larger size, longer leaf cells and its lack of radicles.

6. *PSEUDOLESKEA RADICOSA* (Mitt.) Lesq. & James, Man. of N. A. Mosses. 320. 1884.

Hypnum radicosum Mitt. Jour. Linn. Soc. 8: 31. 1864.

Macounia sciuroides Kindb. Enum. Bryin. Exot. 1888.

Pseudoleskea sciuroides Kindb. Bull. Torr. Bot. Club 17: 276. 1890.

Hypnum congestum Wils. Ms.

Hypnum congestum Hook. & Wils. in Drumm. Musci Am. 225, in part.

Plants in soft tufts, yellow-green to dark green; stems 3–5 cm. long, rather densely radiculose, irregularly branched; branches usually recurved, simple; *paraphyllia* numerous, multiform; stem leaves loosely appressed when dry, spreading when moist, 1.2–1.6 mm. long, 0.35–0.5 mm. wide, secund, subdecurrent, biplicate, from an ovate to oval-oblong base gradually or abruptly contracted to a narrow, oblique, serrulate or entire acumen; margins recurved to base of acumen; costa stout, usually toothed, disappearing in the acumen; cells of stem leaves somewhat loose, often smooth on both surfaces, occasionally lightly papillose on the upper; basal cells oblong-quadrate, in several rows; median oval-oblong to linear-rhomboidal, 8–10 μ wide, 2–4 times as long; alar cells quadrate; apical linear; branch leaves falcate-secund, serrate; perichaetial bracts erect, thin, whitish, finely acuminate, inner subvaginate, lightly costate. Dioicous; pedicels 9–12 mm. long, curved; capsules oval to obovate-oblong, asymmetric, inclined to subpendent, elongated, contracted and arcuate when dry; urn 1.3–1.9 mm. long, 0.7–0.9 mm. wide; exothelial cells thick-walled; teeth reddish margined, confluent into a purplish red basal band 5 joints wide; basal membrane yellow, finely papillose,

$\frac{1}{5}$ – $\frac{1}{4}$ the length of the teeth; *segments oblong-lanceolate*, carinate, somewhat open, about as long as the teeth; cilia rudimentary; annulus narrow, indistinct; operculum conic, sometimes short beaked; spores rough, 14–18 μ , maturing in spring and early summer. Type locality, North America.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: pl. 8, figs. 1–9, 30, 31. 1900; Pl. 54.

EXSICCATI:—Grout, N. Am. Musc. Pl. 399 (as *P. atrovirens*) & 466; Allen, Mosses of the Cascade Mts. 96.

On various substrata, Labrador and New Hampshire to British Columbia and Idaho.

Var. COMPACTA Best, Bull. Torr. Bot. Club 27: 231. 1900.

This variety differs from the usual form in the darker color; the shorter, smaller stems; the short, turgid branches; the often straight stem leaves and the shorter, broader median leaf cells. In the Northwest; less common than the type.

7. PSEUDOLESKEA ATRICHA Kindb. Eur. & N. Am. Bry. 53. 1897.

Pseudoleskea atrovirens var. *atricha* Kindb.; Macoun, Cat. Can. Pl. 6: 180. 1892.

Plants in yellow-green to olive-green mats, stems 2–4 cm. long, prostrate, irregularly branched; branches many, unequal, often curved at the tip; paraphyllia few, lanceolate to linear; stem leaves appressed when dry, erect-spreading when moist, concave, biplicate, often slightly secund, ovate-lanceolate from a more or less decurrent base, abruptly to gradually acuminate, serrulate above, *papillose on both surfaces above*, 0.8–1 mm. long, 0.25–0.35 mm. wide; margins often recurved nearly to apex; costa stout, subpercurrent to percurrent, toothed on the back; cells of stem leaves clear, not uniform; *basal cells oblong*; alar quadrate, thick-walled, extending up the margin; *median cells rhomboidal-hexagonal to sublinear, with thin, pitted walls*, averaging 26 μ long, 7 μ wide; cells of the acumen oblong-hexagonal; apical long-oval to sublinear; perichaetial bracts lanceolate, narrowly acuminate, with sublinear cells; inner subvaginate, thinly costate. Dioicous; sporophyte unknown. Type locality, Griffin Lake, British Columbia; collected by J. Macoun, Aug. 12, 1889.

EXSICCATI:—Grout, N. Am. Musc. Pl. 336.

Rarely collected; on rocks and the trunks of trees, British Columbia and Washington.

P. atricha is puzzling in that it has the aspects of several species without wholly fitting any. Macroscopically, it has the appearance of *P. rigescens*. In being papillose and exhibiting pitted cell walls, it is similar to *P. Baileyi*, but there the similarity stops. The long, stout costa and long, thin-walled median cells are somewhat similar to *P. frigida*, but the oblong basal cells, the large papillae and broad acumen with shorter cells clearly distinguish it from that species. It can be separated from *P. radicata* by smaller, narrower leaves; the slender median cells of leaves, with pitted, thin walls; the longer costa and the larger papillae of the acumen.

8. PSEUDOLESKEA BAILEYI Best & Grout, N. Am. Musc. Pl. 474. 1917.

Plants *large*, in loose tufts, yellow-green to olive-green above, blackish below; stems 3–6 cm. long, not radiculose, irregularly branching; branches curved, usually simple; paraphyllia none; stem leaves loosely appressed when dry, spreading when moist, occasionally recurved at tip, slightly secund, subdecurrent, biplicate below, 2 mm. long, about 0.6 mm. wide, ovate, *mostly attenuate into a pale, short hair-point*; margins recurved below, serrulate near the apex; costa $\frac{3}{4}$ the length of the leaf, often scabrous at the back above; *leaf cells papillose, on both surfaces*, particularly above; basal cells near the costa *elongated with irregularly thickened walls*, near the margin often quadrate; median cells slightly oblique, 12–16 μ long, about 8 μ wide, with unequally thickened walls; apical slender, irregular; perichaetial leaves entire or nearly so, inner oblong-lanceolate, about 2.5 mm. long, outer much shorter. Dioicous; seta 9–11 mm. long; capsule oblong, almost erect to inclined; urn 1.5 mm. long, 1 mm. wide; teeth confluent at the base, reddish below, paler and papillose near the apex; basal membrane $\frac{1}{3}$ the height of the teeth; segments narrow, as long as the teeth, carinate, open; *cilia none*; *annulus none*; operculum short conic, slightly apiculate; spores rough, up to 20 μ in diameter. Type locality, Sunset Trail, Cascade Summit, Washington. Collected by J. W. Bailey, July 19, 1916.

ILLUSTRATIONS:—Williams, Bryol. 27: pl. 13. 1924; Pl. 55.

EXSICCATI:—Grout, N. Am. Musc. Pl. 474.

Known only from Washington. Easily recognized by its size, filiform leaf tips, and the extraordinary, irregularly-thickened walls of the leaf cells.

9. *PSEUDOLESKEA RIGESCENS* (Wils.) Lindb. Act. Soc. Fenn. 10: 277. 1872.

Leskea rigescens Wils. Ms. Drumm. Musc. Am. 225. in part.

Lescuraea radicata var. *gracilis* Lesq. & James, Man. N. A. Mosses, 320. 1884.

Pseudoleskea stenophylla Ren. & Card. Bot. Centralbl. 44: 421. 1890.

Lescuraea imperfecta C. M. & Kindb.; Macoun, Cat. Can. Pl. 6: 170. 1892.

Lescuraea stenophylla Kindb. Eur. & N. Am. Bryin. 26. 1897.

Plants in soft intricate mats, yellow-green; stems 2-4 cm. long, radiculose, irregularly branched; branches unequal, slender, curved; paraphyllia small, linear-lanceolate; stem leaves loosely appressed when dry, erect-spreading when moist, 0.8-1.2 mm. long, 0.25-0.35 mm. wide, lanceolate or ovate-lanceolate, *gradually long and narrowly acuminate*, entire or serrulate above, lightly biplicate; costa thin, disappearing in the acumen; margins plane or revolute below; cells of stem leaves smooth or lightly papillose on the upper surface, rarely on both; basal cells oblong-quadrate in several rows; alar quadrate, extending well up the margins; median sublinear-rhomboidal, 7-8 μ wide, 2-4 times as long; apical oval to sublinear; branch leaves narrower, serrulate above; perichaetial bracts long-lanceolate, narrowly acuminate, thin, erect, whitish, inner subvaginate, scarcely costate. Dioicous; seta erect or slightly curved above, 6-8 mm. long; *capsule small, oval-oblong, usually erect and symmetric; urn 1 mm. long, 0.7 mm. wide; teeth yellow-red, confluent at base into a dark red band 3 joints wide; basal membrane pale yellow, about $\frac{1}{6}$ the length of the teeth; segments linear, nearly as long as the teeth, concave; cilia none; annulus none; spores rough, 14-18 μ , maturing in spring.* Type locality, North America.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: *pl. 8, figs. 10-16, 32, 33.* 1900; *Pl. 54.*

EXSICCATI:—Grout, N. Am. Musc. Pl. 94; Allen, Mosses of the Cascade Mts. 94.

On various substrata in the mountains of the northwest: British Columbia to Idaho.

Some sterile forms of this species cannot be satisfactorily distinguished from *P. radicata*. When fertile, they are easily distinguished by the smaller, suberect capsules with linear peristome segments found on *P. rigescens*.

Var. *HOWEI* Best, Bull. Torr. Bot. Club 27: 233. 1900.

This differs from the type in exhibiting strongly recurved stems and branches; second, serrate, slightly smaller stem leaves with narrowly recurved margins; stouter costa; more compact areolation; and numerous quadrate basal and alar cells which fill $\frac{1}{3}$ of the leaf. Type locality, Mt. Shasta, Calif., collected by Dr. M. A. Howe, Aug. 5, 1894.

EXSICCATI:—Grout, N. Am. Musc. Pl. 337.

10. *PSEUDOLESKEA FRIGIDA* (Kindb.) Sharp, comb. nov.

Lescuraea frigida Kindb. Eur. & N. Am. Bryin. 26. 1897.

Pseudoleskea substriata Best, Bull. Torr. Bot. Club 27: 233, 234. *pl. 8, figs. 17-24.* 1900.

Plants in flattened tufts, yellowish-green to golden-green; stems radiculose, 2-5 cm. long, often pinately branched; branches suberect, usually simple; paraphyllia few, multiform; stem leaves appressed when dry, erect-spreading when moist, 0.8-1 mm. long, 0.3-0.4 mm. wide, straight, deeply biplicate, oval-oblong, gradually acute or acuminate, sometimes wholly smooth, often somewhat papillose on both sides in the upper part; margins strongly recurved nearly to apex, serrate above; *costa subpercurrent to percurrent*, toothed on the back; cells of the stem leaves clear, rather thin-walled; basal cells *oblong-linear* in 2 or 3 rows; alar quadrate, thick-walled, filling the region between the margins and folds, extending upwards and becoming oblong; median cells sublinear, 6 μ wide, 4-6 times as long, *thin-walled*; apical linear. Dioicous; sporophyte unknown. Type locality, Labrador; collected by J. Macoun, 1896.

ILLUSTRATIONS:—Best, l. c.; *Pl. 54.*

Rarely collected; on rocks, Labrador, Vermont, British Columbia, and Lake Lindeman, Northwest Territory.

Best states that the leaves are smooth, but nearly every plant exhibits some leaves which are clearly lightly papillose in the acumen. This, together with its smaller size and shorter, more serrate acumination of the leaves, serves to distinguish *P. frigida* from the European *P. striata* (Schwaegr.) Dixon, to which it is very closely related.

*6. LESKEA Hedw. Sp. Musc. 211. 1801.

Plants small to medium-sized, growing in mats or tufts. Stems prostrate, radiculose, pinnately to fasciculately branched, seldom stoloniferous; central strand either small, rudimentary, or none; paraphyllia sometimes present; leaves usually papillose, ovate to ovate-lanceolate, acute, acuminate or obtuse, usually uncostate, sometimes shortly bicostate, usually entire; leaf cells more or less uniform, median quadrate-hexagonal to oval-oblong; pedicels smooth; capsules usually straight and erect, oval to subcylindric, annulate; *exothecial cells oblong*; teeth lanceolate-linear, divisural line and lamellae usually present; basal membrane narrow; segments linear, often keeled and cleft; cilia, if present, rudimentary; opercula mammillate to long-conic; calyptra cucullate, smooth.

KEY.

- | | |
|---|--------------------------|
| 1. Median cells of leaves isodiametric; peristomial teeth incurved when dry..... | 2. |
| Median cells of leaves longer than wide; peristomial teeth straight when dry..... | 6. |
| 2. Leaves averaging less than 0.6 mm. in length; costa rough below; median leaf cells 5-7 μ wide..... | 5. <i>australis</i> . |
| Leaves averaging more than 0.7 mm. in length; costa smooth; median leaf cells 7-10 μ wide..... | 3. |
| 3. Leaves more than twice as long as wide..... | 4. |
| Leaves less than twice as long as wide..... | 5. |
| 4. Capsules straight; operculum short-conic..... | 1. <i>polycarpa</i> . |
| Capsules curved; operculum long-conic..... | 2. <i>arenicola</i> . |
| 5. Leaves symmetric, biplicate; margins often revolute..... | 3. <i>gracilescens</i> . |
| Leaves asymmetric, not plicate; margins plane..... | 4. <i>obscura</i> . |
| 6. Costa extending well into the acumen..... | 6. <i>nervosa</i> . |
| Costa barely reaching the acumen or shorter..... | 7. |
| 7. Some of the median cells of the leaves 3-5 : 1; margins sometimes serrulate above.... | 7. <i>Williamsi</i> . |
| None of the median cells of the leaves over 3 : 1; margins entire..... | 8. |
| 8. Leaves with papillae very rare or wanting..... | 8. <i>lectorum</i> . |
| Leaves with low papillae..... | 9. <i>cyrtophylla</i> . |

1. LESKEA POLYCARPA [Ehrhart] Hedw. Sp. Musc. 225. 1801.

Leskea polycarpa Ehrh. Dec. Crypt. n. 96. 1788.

Hypnum multiflorum P. B. Prodr. 66. 1805.

Hypnum polycarpum C. M. Syn. 2: 469 and 690. 1851.

Leskea paludosa var. *polycarpa* Hartm. Skand. Fl. (Ed. 5) 337. 1849.

Plants in loose mats, pale green, sometimes dirty dark- to yellowish-green or reddish brown; stems 2-4 cm. long, subpinnately branched; *central strand small but distinct*; paraphyllia few, linear-lanceolate; stem-leaves loosely appressed when dry, erect-spreading when moist, 0.8-1.2 mm. long, 0.35-0.45 mm. wide, from a subcordate, slightly decurrent, ovate to oblong-ovate base, *lanceolate*, gradually acute to abruptly acuminate, more or less secund and obliquely pointed, biplicate, entire, usually recurved on one or both basal margins, costa disappearing below apex; branch-leaves smaller, often obtuse or blunt-pointed; median cells of stem leaves roundish quadrate-hexagonal, 7-8 μ wide, with one or two small papillae on each surface; basal quadrate-oblong; alar quadrate or transversely oval. Monoicous; perichaetal bracts erect, oblong-lanceolate, plicate-striate, *lightly costate*; pedicel about 1 cm. long, flexuose, capsule erect, *straight or slightly curved*, subcylindric, tapering at the base, yellowish or reddish brown at maturity, wrinkled and contracted below the mouth when dry; urn about 2 mm. long, 7 mm. wide; teeth yellowish, linear-lanceolate, lamellate, *divisural line distinct*; basal membrane about $\frac{1}{5}$ - $\frac{1}{4}$ the length of the teeth; segments linear, scarcely open on the keel, equaling the teeth in length; cilia rudimentary or none; annulus of 2 rows of cells; *operculum conic*; spores usually smooth, 9-12 μ , maturing in early summer. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 470; Husnot, Musc. Gal. *pl.* 85; Dixon & Jameson, Handbook, *pl.* 50; Braithwaite, Brit. Moss Flora 3: *pl.* 86; Limpricht, Laubm., *f.* 343; Broth., Eng.-Prantl, Pflanzenfam. (Ed. 2) 11: 301, *fig.* 651. 1925; M. H. M. *pl.* 56.

* See footnote page 185.

EXSICCATI:—Drumm. Musc. Amer. 223 (as *Hypnum medium* Dicks.).

On the base of trees, rotten wood, rarely on stones or the ground, Newfoundland to the Rocky Mountains, southward to the central states.

LESKEA POLYCARPA var. PALUDOSA (Hedw.) Schimp. Syn. 486. 1860.

Leskea paludosa Hedw. Descr. 4: 115. 1797; Sp. Musc. 221. 1801.

Hypnum inundatum Dicks. Crypt. 4: 17. 1801.

Leskea palustris Hedw. Descr. 4: 1. pl. 1. 1793.

Leskea subobtusifolia C. M. & Kindb.; Macoun, Cat. Can. Pl. 6: 169. 1892.

Leskea polycarpa var. *subobtusifolia* (C. M. & Kindb.) Best, Bull. Torr. Bot. Club, 30: 466. 1903.

A variety which often cannot be distinguished readily from the species, but is generally more robust, more diffusely branched, with longer stems and branches somewhat curved at the tips. Capsules often somewhat longer.

ILLUSTRATIONS:—Hedw. l. c.

EXSICCATI:—Grout, N. Am. Musc. Pl. 233, 296, and 343.

In more moist places than the species, sometimes submerged, about the base of trees and on rotten wood, rarely on stones. New England, Minnesota and North Dakota to British Columbia and Oregon.

2. LESKEA ARENICOLA Best, Bull. Torr. Bot. Club, 30: 467. pl. 15, figs. 1-13. 1903.

Plants somewhat rigid, in loosely spreading tufts, pale yellowish-green to reddish-brown; stems 2-5 cm. long, pinnately branched; branches simple, ascending, sometimes curved, *central strand small, distinct*; paraphyllia mostly linear-lanceolate; stem-leaves rigid, secund, 0.4-0.5 mm. wide, 0.8-1 mm. long, *ovate to ovate-lanceolate*, obliquely acuminate, acute to blunt-pointed, scarcely biplicate, margins usually recurved at base, entire or sinuate-serrulate above, costa disappearing in the acumen; leaf cells stoutly unipapillate except for the generally smooth upper alar surface; alar quadrate; median oval-rhombic to oblong-fusiform, 7-9 μ wide, nearly twice as long, branch-leaves about $\frac{1}{3}$ smaller and scarcely secund. Monoicous; perichaetial bracts appressed, plicate, *costate*, long and narrowly acuminate; pedicel 1.5 cm. long, grooved, curved, reddish; capsule oblong-cylindric, *curved*, tapering at the base wrinkled when dry; urn about 2 mm. long, 0.6 mm. wide; teeth lanceolate-linear, yellowish below, pale above, densely papillose, *divisural line faint*, ventral surface strongly lamellate; basal membrane yellowish, papillose, *about $\frac{1}{7}$ the length of the teeth*; segments as long as the teeth, split, open on the keel; cilia rudimentary; annulus broad, 2 or 3 rows of cells; operculum whitish, subshining, *long conic*, nearly one half the length of the urn; spores smooth, 10-13 μ , maturing in early summer. Type locality Smyrna, Delaware.

ILLUSTRATIONS:—Best l. c.; M. H. M. pl. 57, figs. 1-13.

EXSICCATI:—S. & L. Musc. Bor. Am. 243 and 365 as *L. obscura*; Ren. & Card. Musc. Am. Sept. 192b as *L. polycarpa forma*; Grout, N. Am. Musc. Pl. 147 and 212.

On the base of trees, rarely on rotten wood, in sandy places. New England to Virginia, westward to Minnesota and North Dakota.

3. LESKEA GRACILESCENS Hedw. Spec. Musc. 222. pl. 56, figs. 8-13. 1801.

Hypnum gracilescens P. B. Prodr. 64. 1805.

Leskea intermedia Best, Bull. Torr. Bot. Club, 30: 469. 1903.

Plants in intricate spreading tufts, various shades of green to reddish-brown or blackish; stems 2-4 cm. long, pinnately branched; *central strand rudimentary or none*; branches simple, erect, often subjulaceous; paraphyllia few, rarely none, lanceolate; stem-leaves appressed-imbricated when dry, erect-spreading when moist, 0.4-0.5 mm. wide, 0.65-0.9 mm. long, ovate, gradually acute, obtuse or blunt-pointed, straight, *highly biplicate, symmetric*, margins entire, *often more or less revolute*, costa subpercurrent; branch-leaves similar, not plicate; leaf cells somewhat uniform, *unipapillate on lower surface, usually smooth on upper*; median quadrate-hexagonal, 8-10 μ broad; alar and basal quadrate, apical roundish. Monoicous; perichaetial bracts erect, striate, blunt, *costate*; pedicel 8-10 mm. long; capsule erect, oblong-cylindric, tapering at base, substriate and reddish when empty; annulus of 2 rows of cells, deciduous; teeth *whitish*, linear-lanceolate, lamellate, *divisural line faint*; *basal membrane $\frac{1}{4}$ the length of the teeth*; segments linear, usually shorter than the teeth, carinate, open, sometimes poorly developed and unequal; cilia none; operculum conic, obtuse or acute; *spores 8-11 μ* , smooth, maturing in early summer. Type locality, Pennsylvania.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. pl. 77 probably; Pl. 71.

EXSICCATI:—Grout, N. Am. Musc. Pl. 117 & 211.

On the base of trees, rotten wood, stones, and the ground. Common in northeastern U. S. to the Rocky Mountains, rare in Canada and the south, absent on the Pacific Coast.

4. LESKEA OBSCURA Hedw. Spec. Musc. 223. pl. 57. figs. 1-9. 1801.

Leskea obtusa R. & C. Bot. Gaz. 17: 296. 1892.

Leskea ? *Cardoti* Kindb. Rev. Bryol. 22: 83. 1895.

Plants in loose spreading tufts, rarely in mats, deep green to dark olive-green, older parts reddish brown; stems 3-5 cm. long, sparingly branched; *central strand small, distinct*; paraphyllia few, lanceolate, or none; branches short, tumid, or elongated and slender; stem-leaves incurved-appressed when dry, patulous when moist, oblong-ovate, 0.4-0.6 mm. wide, 0.8-1.3 mm. long, straight or slightly curved, *thickish*, concave, subcarinate, *scarcely plicate, asymmetric, margins plane*, apex rounded-obtuse to subacute, entire or serrulate, costa disappearing below apex; branch leaves similar, more symmetric, sometimes short-acuminate; leaf cells somewhat uniform, *pluripapillate on the lower surface with small papillae, papillose or nearly smooth on the upper*; median cells quadrate-hexagonal, 8-10 μ wide; basal quadrate-oblong, apical smaller, isodiametric. Monoicous; perichaetial bracts erect, appressed, costate, blunt-pointed; pedicel reddish, 1-1.5 cm. long; capsule erect, straight, oblong-cylindric, thin-walled, yellowish, wrinkled and slightly contracted below the mouth when dry; urn 1.75-2.25 mm. long, 0.8 mm. wide; teeth linear-lanceolate, *yellowish*, papillose, lamellate, *divisural line distinct below, faint above*; basal membrane yellowish, *about 1/2 the length of the teeth*; segments linear, densely papillose, more or less open, shorter than the teeth; annulus of 2 rows of cells; operculum short-conic, obtuse or apiculate; *spores 11-14 μ , smooth, maturing in early summer*. Type locality, Pennsylvania.

ILLUSTRATIONS:—Card. Bull. Herb. Boiss. 7: pl. 9. fig. 4; Best, Bull. Torr. Bot. Club, 30: pl. 15. figs. 14-27; Jennings, Mosses W. Pa. pl. 35; M. H. M. pl. 57. figs. 14-27.

EXSICCATI:—Drumm. Musc. Amer. 105; Aust. Musc. Appal. 270; R. & C. Musc. Am. Sept. 193; Grout, N. Am. Musc. Pl. 331.

On the base of trees or rotten wood; less frequently on stones or moist soil. Widely distributed east of the Rocky Mountains.

In addition to the points emphasized above, *L. obscura* generally has a larger sporophyte than *L. gracilescens*.

5. LESKEA AUSTRALIS Sharp, *nom. nov.*

Leskea microcarpa Schimp., Sull. Musc. & Hepat. of the U. S. 59. 1856. (Not of Brid. 1827.)

Plants smallest of the genus, in thin spreading tufts, yellowish green to dark green; *stems 1-3 cm. long*, subpinnately branched; *central strand minute or none*; paraphyllia few, small, lanceolate; stem-leaves somewhat rigid, appressed when dry, spreading when moist, 0.25-0.4 mm. wide, 0.4-0.6 mm. long, ovate, subcordate, more or less narrowly long-acuminate, entire, basal margins revolute, costa subpercurrent, *rough below*; branch leaves smaller, acute to narrowly acuminate; leaf cells *small, angular*, papillose on the lower surface, usually smooth on the upper; median cells quadrate-hexagonal, *irregular, often indistinct*, 5-7 μ wide; alar oval-quadrate in about 6 rows. Monoicous; perichaetial bracts somewhat loose, erect or spreading at tips, long and narrowly acuminate, *costate*; pedicel erect, 5-7 mm. high; capsule erect, oval-oblong, reddish-brown, shining; urn about 1.5 mm. long and 0.6 mm. wide; teeth fragile, *whitish*, papillose, linear-lanceolate, 0.25 mm. long, confluent at the slightly broadened base, not markedly bulging when dry, divisural line faint or none; basal membrane thin, whitish, about 1/4 the length of the teeth; segments short, often rudimentary; annulus narrow, 1 or 2 rows of cells; operculum conic, short-beaked; *spores slightly roughened, 9-13 μ , maturing in spring*. Type locality, Alabama.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club, 30: pl. 15. figs 28-40. 1903; Pl. 52.

EXSICCATI:—Drumm. Musc. Amer. (South. States) 89 (as *L. nervosa*); Sull. Musc. Allegh. 69 (as *L. nervosa*); Ren. & Card. Musc. Am. Sept. 194 (as *L. gracilescens*); Langlois, Fl. Ludov. 246, Grout, N. Am. Musc. Pl. 375.

On roots of trees, rotten wood, rarely on the ground. In the Gulf States: Florida to Texas.

6. LESKEA NERVOSA (Schwaegr.) Myrin, Coroll. Fl. Upsal. 52. 1834.

Pterogonium nervosum Schwaegr. Suppl. 11: 102. 1811.

Leskea bulbifera Froehl.; Brid. Sp. Musc. 2: 61. 1812.

Anomodon rigidulus Kindb. Laubm. Schwed. u. Norw. 11. 1883.

Amblystegium montanae Bryhn, Bryol. 5: 26. 1902.

Leskea montanae (Bryhn) Grout, Moss Flora 3²: 75. 1931.

Plants in thin appressed tufts, pale to dark green, becoming brown or black with age; stems 4–7 cm. long, without paraphyllia, pinnately branched; branches simple, ascending, sometimes branched; central strand small, distinct; stem leaves broadly ovate, subcordate, slightly decurrent, abruptly long-acuminate, 0.35–0.5 mm. wide, 0.8–1.3 mm. long; acumen narrowly lanceolate-linear, more or less recurved, margins plane, subsinuate; body concave, biplicate, margins sometimes recurved on one or both sides; costa subpercurrent, narrow, scarcely tapering; branch leaves smaller, narrow, erect-spreading; leaf cells smooth or scarcely papillose; median cells oval-hexagonal to oval-oblong, 7–9 μ \times 8–12 μ ; alar quadrate to transversely oval in 5 or 6 rows, extending well up the margins and becoming isodiametric. Dioicous; perichaetial bracts long and narrowly acuminate, slightly costate, inner erect; pedicel 10–12 mm. long; capsule erect, subcylindric, brownish, wrinkled when dry; urn 2.2 mm. long, 0.7 mm. wide; teeth erect, confluent at base, linear-lanceolate, yellowish, margined, dorsal surface finely striate, divisural line zigzag, ventrally lamellate, basal membrane narrow, about $\frac{1}{4}$ the length of the teeth; segments irregular, unequal, sometimes rudimentary; annulus of 2 rows of cells, deciduous in fragments; operculum conic, obliquely short-beaked; calyptra reaching the base of the capsules; spores roughened, 12–15 μ , maturing in summer. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. pl. 472; Husn. Musc. Gall. pl. 86; Best, Bull. Torr. Bot. Club, 30: pl. 16, figs. 41–54; Jennings, Mosses W. Pa. pl. 35; Broth., Eng.-Prantl, Pflanzenfam. (Ed. 2) 11: fig. 652. 1925; M. H. M. pl. 57, figs. 41–54.

EXSICCATI:—Aust. Musc. Appalach. 271; Grout, N. Am. Musc. Pl. 133, 175 & 217.

On the base of trees, rarely on rotten wood or stones, Labrador to British Columbia, south to Pennsylvania and Colorado. Usually sterile in the southern part of its range, more frequently fertile northward.

Fertile plants collected at Smuggler's Notch, Vt., by C. G. Pringle differ little from European material of this species, but show distinct lamellae on the teeth. In the writer's opinion, this is sufficient to keep it in the genus *Leskea*.

Husnot's figures show a much longer costa than is present in the most of the American material.

Var. *NIGRESCENS* (Kindb.) Best, Bull. Torr. Bot. Club, 30: 474. 1903.

Leskea nigrescens Kindb. Bull. Torr. Bot. Club, 16: 97. 1889.

Leskea nervosa var. *flagellifera* Kindb. Ottawa Nat. 4: 62. 1890.

Anomodon heteroideus Kindb.; Macoun, Cat. Can. Pl. 6: 62. 1890.

Plants smaller, sterile, in intricate mats, dirty yellowish to dark green or black; stems scarcely radiculose, defoliate or with distant, ovate, narrowly acuminate, recurved leaves; branches few, irregularly arranged, short, with many flagelliform branchlets, often with bulbils at their tips; leaves of branchlets rudimentary, scarcely costate. With the species but less common.

7. *LESKEA WILLIAMSII* Best, Bull. Torr. Bot. Club, 30: 476. pl. 16. figs. 55–68. 1903.

Plants small, in spreading rather lustrous tufts, pale yellow to golden brown; stems slender, pinnately branched, 2–4 cm. long; central strand none; branches ascending, simple or with flagellate branchlets; lower stem-leaves decolorate, rotund-ovate, abruptly acuminate, costa short; upper stem-leaves appressed when dry, erect-spreading when moist, straight or subsecund, entire or serrulate above, ovate-lanceolate, acuminate, acumen nearly as long as the biplicate body, 0.25–0.35 mm. wide, 0.4–0.5 mm. long; margins plane or recurved below; costa thin, rarely extending beyond the middle; branch leaves 0.15–0.2 mm. wide, 0.25–0.4 mm. long, often serrulate above; leaf cells smooth, clear; median linear-rhomboidal to fusiform, subvermicular, about 6 μ wide, 3–5 times as long; alar quadrate to transversely-oval, in about 4 rows, extending well up the margin and becoming oval-oblong. Dioicous; perichaetial bracts oblong-lanceolate, acuminate, striate-plicate; pedicel flexuose, reddish, about 1 cm. long; capsule straight, erect or inclined, oblong-cylindric, tapering at the base, often narrower in the upper half than in the lower; urn 2 mm. long, 0.7 mm. wide, brownish; teeth reddish, incurved when dry, lanceolate, confluent at base, finely striate below, rugulose above, divisural line distinct, ventral surface lamellose; basal membrane strongly reticulated, about $\frac{1}{4}$ the length of the teeth; segments narrow, concave-keeled, gaping, about as long as the teeth; cilia none; annulus of 2 rows of pellucid cells, deciduous with the operculum; operculum conic, straight or obliquely beaked; calyptra reaching to the base of the capsule; spores smooth, 10–13 μ , maturing in summer. Type locality, Montana.

ILLUSTRATIONS:—Best l. c.; *Pl.* 52.

On rocks and rotten wood, Montana, Minnesota, and Owen Sound, Ontario (Moxley).

Var. *FILAMENTOSA* Best, Bull. Torr. Bot. Club, 30: 477. 1903.

Sterile delicate plants with stems which are defoliate or with few rudimentary leaves, sparingly branched; branches filiform, diffusely spreading, with brittle, flagellate branchlets; branch-leaves smaller than those of the species; those of the branchlets still smaller and sometimes rudimentary.

EXSICCATI:—Drumm. Musc. Am. 219, in part; Brandegee's Mosses of S. Col. 38.

On rocks in the Rocky Mts.

8. *LESKEA TECTORUM* (A. Braun) Lindb. Bot. Notis. 1865: 73. 1865.

Pterogonium tectorum A. Braun; Brid. Bryol. Univ. 2: 582. 1827.

Pseudoleskea tectorum (A. Braun) Milde, Bot. Zeit. 1864, Beih. p. 8.

Leskea Wollei Aust. Bull. Torr. Bot. Club, 5: 28. 1874.

Pseudoleskea malacoclada C. M. & Kindb., Macoun, Cat. Can. Pl. 6: 182. 1892.

Anomodon subrigidulus Kindb. Eur. & N. Am. Bryin. 11. 1897.

Anomodon tectorum Kindb. Eur. and N. Am. Bryin. 11. 1897.

Plants small, in rather dense lustrous tufts, deep green to reddish-brown or black; stems 2–5 cm. long, pinnately branched; branches ascending, short, simple, sometimes with flagellate branchlets, sharply pointed when dry; *central strand small, distinct*; paraphyllia few or none, lanceolate; lower stem-leaves broadly ovate, abruptly and narrowly acuminate, acumen spreading or recurved; upper stem-leaves sub-decurrent, ovate, abruptly acuminate; *acumen shorter than the concave scarcely plicate body*; margins entire, plane or recurved on one or both sides below; branch-leaves ovate, abruptly or gradually acuminate; margins plane, *entire*, very rarely minutely serrulate above; costa short, simple, sometimes forking, rarely none; leaf cells smooth, clear; median cells oval-oblong to oblong-rhomboidal, *rounded at both ends*, 9–12 μ wide, 1½–3 times as long; alar transversely compressed in 5–7 rows; upper rhombic-oval or roundish. Dioicous; only sterile plants known from North America. Type locality Germany.

(Perichaetial bracts erect, long-acuminate, the inner shorter, blunt-pointed and coarsely serrate at the apex; seta purple, 1.5 cm. long; capsule cylindric, somewhat curved, reddish-brown; urn 2.7 mm. long \times 0.75 mm. wide; annulus present; teeth of peristome lanceolate, yellowish; basal membrane of inner peristome ¼ length of the teeth; segments about as long as the teeth, keeled; cilia none or rudimentary; spores in August.)†

ILLUSTRATIONS:—Husn. Musc. Gall. *pl.* 86; Best, Bull. Torr. Bot. Club, 30: *pl.* 16, *figs.* 69–76; *Pl.* 52. On rocks, rotten wood and bases of trees, Lake Superior to British Columbia and from Yukon to the southern Rocky Mts..

Var. *FLAGELLIFERA* Best, Bull. Torr. Bot. Club, 30: 479. 1903.

This differs from the species in the usually defoliate stems; filiform branches with many, deciduous, flagellate branchlets; smaller branch-leaves. It differs from *L. Williamsi filamentosa* in its entire leaves and larger leaf cells. Widely distributed.

EXSICCATI:—Grout, N. Am. Musc. Pl. 219 & 413; Bartram, Mosses of S. Ariz. 160.

*9. *LESKEA CYRTOPHYLLA* Kindb.; Macoun, Cat. Can. Pl. 6: 169. 1892.

Leskea subcyrtophylla Card. & Thér., apparently unpublished.

Plants very small, in compact tufts, deep green to rusty brown; stems 1–2 cm. long, scarcely radiculose, irregularly branched; branches erect, simple or with flagellate branchlets; paraphyllia rarely present; stem-leaves somewhat spreading, roundish-ovate, concave, broadly inserted, 0.3–0.4 mm. wide, 0.4–0.5 mm. long, abruptly acuminate; acumen usually sharp-pointed; costa short, thin, usually forking; margins entire, sometimes recurved below; branch-leaves roundish-ovate, rather gradually acute or short-acuminate, often blunt-pointed, 0.2–0.25 mm. wide, 0.25–0.35 mm. long; *leaf cells rounded or angular, not uniform*, somewhat clear, with *usually a small flat subcentral papilla on each surface*; median cells oval-rhombic, 9–13 μ wide, 12–16 μ long; alar transversely compressed, in 5–7 rows. Apparently dioicous; only sterile plants known. Type locality Lake Nipigon, Canada. *Pl.* 71.

† Abstracted from Limpricht, Laubm. 2: 271.

On rocks and stones, Ontario, Minnesota, and Colorado.

This is very closely related to *L. tectorum* from which it is to be distinguished by the much more orbicular leaves which exhibit at least a few papillae.

In Dr. Grout's herbarium there is a packet of moss collected by C. F. Baker and J. M. Holzinger, May 31, 1896, in Colorado. It is labeled "*Leskea subcyrtophylla* Card. & Thér. Co-Type." I can find no record of such a species in the literature and assume it was unpublished. It differs little from *L. cyrtophylla*.

7. LINDBERGIA Kindb. Eur. & N. Am. Bryin. 1: 13. 1897.

Rather small, soft, loosely tufted plants; stems elongated, thickly and regularly foliate, irregularly divided and branched; paraphyllia few or lacking; leaves imbricate when dry, spreading to almost squarrose when moist, somewhat concave, not plicate, nearly or quite entire; margins plane; costa well developed in our species, reaching the leaf middle or beyond; leaf cells rounded oval to rhombic-hexagonal, papillose in our species. Monoicous; seta 5–20 mm. long; capsule erect and symmetric, oblong-ovoid; annulus present or lacking; inner peristome of a low membrane or lacking. Type species *L. brachyptera*.

LINDBERGIA BRACHYPTERA (Mitt.) Kindb. Eur. & N. Am. Bryin. 1: 13. 1897.

Pterogonium brachypterum Mitt. Journ. Linn. Soc. 8: 37. 1865.

Stems procumbent, irregularly pinnate with short branches, leaves densely imbricate, broadly deltoid-ovate, acuminate with a narrow acumination, concave; margins plane, minutely serrulate above; costa vanishing a little beyond the middle of the leaf; angular leaf cells minute, rounded, the others short-oval, longer at the apex, all distinctly papillose; perichaetial leaves erect, ovate-acuminate, entire; costa vanishing above the middle, with cells elongated, the alar lax. Monoicous; seta elongated ("½ inch"), rather stout, light colored; capsule ovoid-cylindric, erect, symmetric; operculum short-conic; peristome teeth short, inserted below the mouth of the capsule, the inner a short membrane.

British North America, *Drummond*.

The above description is translated from the original Latin. Mitten's type has been studied. The plants are stouter than in the var. *Austinii*, the leaves are deltoid-ovate to broadly rounded-ovate and more abruptly acuminate. The leaves are much broader than those figured by Sullivant for the variety, but the shape of the leaves varies greatly, even on the same plant. In a plant collected by the author, named *Austinii* by Best, there are leaves that will fit either shape. The peristomes do not differ materially.

Var. AUSTINII Sull. n. comb.

Leskea Austinii Sull. Icones Musc. Suppl. 81. pl. 61. 1874.

Fabroleskea Austinii Best, Bull. Torr. Bot. Club, 25: 108. 1898.

Lindbergia Austinii Broth. in Engler & Prantl, Musci (Ed. 1) 993. 1907.

Plants of medium size, bright green in the younger parts; stems 2–3 cm. long; *stem leaves widely spreading to squarrose when moist*, concave, ovate to ovate-lanceolate, gradually broadly acuminate to rather abruptly and slenderly acuminate, 0.7–1.2 x 0.35–0.5 mm.; margins plane, entire or slightly irregular above; costa strong usually reaching beyond the leaf middle; leaf cells thick-walled, the *median rounded-oval to rhombic-fusiform*, 9–12 μ wide, 1½–2 : 1, somewhat elongated in the costal region, basal and marginal rounded and nearly isodiametric, apical elongated, *all except the apical with a large central papilla on each surface*; perichaetial leaves oblong-lanceolate, more gradually and more slenderly long-acuminate, cells elongate, scarcely or not at all papillose. Seta smooth, 8–20 mm. long; capsule oblong-ovoid, \pm 1.5 mm. long; operculum conic, blunt; *annulus lacking*; *pseudannulus of 7 rows of oblong-oval compressed yellowish cells*; outer peristome of 16 rather broad, obtuse, lanceolate, *papillose teeth, deeply inserted and confluent at base*; inner peristome of a narrow yellowish membrane, often scarcely apparent; spores minutely roughened, 19–26 μ in diameter, maturing late winter to early spring. Type locality Illinois, according to Best.

ILLUSTRATIONS:—Sull. l. c.; Pl. 51.

EXSICCATI:—Aust. Musc. Appal. 267; R. & C. Musc. Am. Sept. 317.

On bark of trees and stones, also on limestone; rare but widely distributed; Quebec to Minnesota, and British Columbia, south to S. Carolina, Kansas and Arizona.

Gemmae of very short branchlets with minute papillose leaves are present in most specimens. This species has the leaves of a *Leskea* with the peristome of the Fabroniaceae. (See Best, l. c.)

8. PTERIGYNANDRUM Hedw. Stirp. Crypt. 4: 55. *pl.* 20. 1793. And Sp. Musc. 80. 1801.
We have only one species.

PTERIGYNANDRUM FILIFORME Hedw. l. c. 81. 1801.*

Pterigynandrum filiforme cristatum (Hampe) Lesq. & James Man. 289. 1884.

Plants small, slender in thin patches resembling *Leskea*; primary stems creeping; secondary ascending with irregularly placed, often flagelliform branches, usually less than 10 mm. long, julaceous; paraphyllia small, varying from filiform to many-branched forms; leaves small, 0.4–0.6 mm. long, obovate to oval-elliptic, close, closely imbricate when dry, concave, not plicate, occasionally somewhat secund, short-acuminate to almost obtuse, slightly denticulate or entire above, more or less papillose at back by the projecting cell angles; margin somewhat reflexed below; costa almost wanting or short and double or occasionally single and reaching well towards the leaf middle; median leaf cells narrowly rhomboidal to shortly linear-vermicular, about $7\ \mu$ wide, 3–5 : 1, broader and shorter at the apex; angular cells quadrate to short rectangular in several rows; inner perichaetial leaves broadly lanceolate, sheathing, acute, with plane entire margins. Dioicous; seta 8–10 mm. long; capsules erect and usually symmetric, 1–2 mm. long; annulus present; operculum conic-rostrate; peristome teeth rather short and narrow; inner peristome of 16 short irregular segments, without cilia, basal membrane very narrow or lacking; spores in summer, rarely produced. Type locality, Mecklenburg.

ILLUSTRATIONS:—Bry. Eur. *pl.* 466; M. H. M. f. 134.

EXSICCATI:—Drumm. Musc. Am. 77; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 230b, (Ed. 2) 348; Aust. Musc. Appal. 280; Grout, N. Am. Musc. Pl. 147, 383 & Suppl. 3; Allen, Mosses Cascade Mts. 147; R. & C. Musc. Am. Sept. 384.

On roots and bases of trees, also on damp stones. Greenland to British Columbia, southwards to northern U. S. Variations in this species are common and often extreme. The average American plant is somewhat different from the European but almost any form of one continent can be matched from the other.

A frequent form in the West has secondary stems and branches together reaching 2–3 cm. in length, flagelliferous at ends, scarcely julaceous; leaves more distant, more strongly serrate and more sharply acute.

Forma PAPILLOSULUM (C. M. & Kindb.) n. comb.

Pterigynandrum papillosulum C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 165. 1892.

Plants rather slender, *not* "blunt and turgid"; leaves acute and sharply but finely toothed above, in many cases finely toothed to area of quadrate angular cells, with papillae at back exceptionally *large and sharp*, *not* "less papillose" as described. Plants from type collection, "Deer Park, B. C., June 4th, 1890 (J. Macoun)," Can. Musci 553, seen and studied.

Var. MINUS Lesq. & James, Manual 289. 1884.

A small depauperate form of unfavorable habitat on rocks; leaves scarcely papillose or serrate; costa almost obsolete. The original description says that the segments are as long as the teeth. This has not been verified since, as fruit is extremely rare. The variety as described above is apparently not rare within the range of the species.

EXSICCATI:—Grout, N. Am. Musc. Pl. 142 & 142a.

Var. DECIPIENS (Web. & Mohr) Limpr. l. c. 786.

Neckera decipiens Web. & Mohr. Bot. Taschenb. 241 & 473. 1807.

Pterigynandrum heteropterum Brid. Bryol. Univ. 2: 176. 1827.

A more robust better developed form; branches blunt, curved, never flagelliform, leaves secund, 1–1.2 mm. long and mostly bluntly apiculate. Capsule often unsymmetric, reaching 3 mm. in length; peristome better developed; segments as long as the teeth.

Reported from Newfoundland, Cape Breton Island and the Yukon.

✓ Subfamily THELIEAE.

Small mosses with julaceous branches and mostly broadly ovate to subcircular, apiculate to acuminate leaves, concave and more or less spoon-shaped; leaf cells strongly papillose with very large single or forked

*For a long list of synonyms see Limpricht, Laubm. 2: 784.

papillae (except *Myurella* species); costa single, rather short to almost lacking, sometimes forking; capsules erect and symmetric; inner peristome imperfect to perfect.

KEY TO THE GENERA.

- Paraphyllia present; segments of inner peristome rudimentary or lacking..... 10. *Thelia*.
Paraphyllia lacking; segments of inner peristome well developed, with cilia..... 9. *Myurella*.

9. MYURELLA Bry. Eur. fasc. 46-47. 1851.

Plants very slender, forming loose tufts or mats, light to bluish-green; stems ascending to erect, irregularly branched, the branches often subfasciculate, with leaves 0.3-0.5 mm. thick; small-leaved stolons present; leaves round-ovate, obtuse, abruptly apiculate or acuminate, very concave; margins plane to involute; costa mostly short and slender or nearly lacking; leaf cells small, elliptic to elliptic-fusiform, smooth or papillose; perichaetial leaves very different, lanceolate to ovate-lanceolate, long acuminate with elongated leaf cells, usually smooth. Dioicous; seta smooth; capsules erect to inclined, symmetric or nearly so, oblong-ovoid from a short neck; peristome perfect, with segments about the length of the teeth, cilia shorter; operculum conic. Type species, *M. julacea*.

KEY.

1. Plants usually densely caespitose; leaves mostly obtuse, often apiculate..... 1. *julacea*.
Plants often loosely tufted; leaves apiculate to acuminate..... 2.
2. Leaves with a single large papilla on lumen of each cell dorsally..... 3. *Careyana*.
Leaves with low papillae dorsally at cell angles..... 3.
3. Leaves acuminate, upper $\frac{1}{2}$ spreading to squarrose, costa often well developed..... 4. *squarrosa*.
Leaves apiculate, costa wanting or nearly so..... 2. *tenerrima*.

1. MYURELLA JULACEA (Vill., Schwaegr.) Bry. Eur. l. c. pl. 560.

Leskea julacea Schwaegr. in Schultes' Reise auf d. Glockner 2: 363. 1804.

Plants light green above, caespitose, often densely so, cushions reaching 2 cm. in depth, or other times in loose mats, somewhat brittle when dry; stems suberect, divided, freely and irregularly branching; branches crowded, julaceous, almost filiform, reaching 10-12 mm. in length, usually shorter; leaves imbricate-appressed, wet or dry, subcircular to rounded-ovate, narrow at the insertion, very concave, obtuse to short-apiculate, 0.3-0.5 mm. long, more or less papillose dorsally by the projecting cell angles, serrulate by projecting cell angles, especially near base; costa faint to lacking; median leaf cells irregular, rhombic-hexagonal to rhomboidal, 15-20 μ long, $\pm 2:1$; median basal elongated, at the insertion and angles short-rectangular to quadrate. Capsule oblong-ovoid, with neck and operculum reaching 1.5 mm. long; annulus large; spores in summer. Type locality, France.

ILLUSTRATIONS:—Bry. Eur. l. c.; Limpr. Laubm. 2: 750, f. 342; Pl. 50.

EXSICCATI:—Aust. Musc. Appal. 266; Grout, N. Am. Musc. Pl. 376; Drumm. Musc. Am. 220 (as *Hypnum moniliforme*).

A subalpine moss, growing on rocks, especially limestone; Greenland west to the Rocky Mts. and Oregon, north to the Yukon, south to Connecticut, New York and Colorado; rare.

Var. *SCABRIFOLIA* Lindb. Musc. Scand. 37. 1879.

Leaves distinctly apiculate, more strongly papillose, serrate with larger teeth at base. Old marble quarry, Dorset, Vermont, N. Am. Musc. Pl. 435 (associated with *M. Careyana*).

2. MYURELLA TENERRIMA (Brid.) Lindb. Musc. Scand. 37. 1879.

Pterigynandrum (?) *tenerrimum* Brid. Musc. Recent. Suppl. 4: 132. 1819.

Isoetecium apiculatum Huebn. Muscol. Germ. 598. 1833.

Myurella apiculata Bry. Eur. l. c. pl. 560.

Resembling the last. Plants yellowish green, less glaucous, with leaves distinctly more distant and less closely appressed, all with an apiculus which often becomes a rather slender acumination and is more or less spreading when moist; margins less markedly serrulate; costa almost or quite lacking; leaf cells usually less papillose, often smooth. Type locality, Switzerland.

ILLUSTRATIONS:—Bry. Eur. *pl.* 560; *Pl.* 50.

EXSICCATI:—Hunker Creek, Yukon, Macoun, No. 231; Drumm Musc. Am. 220 (in part).

On moist alpine rocks, very rare; Greenland, Utah, British Columbia, and Dawson in Yukon Terr. (Williams).

The leaf apices are less recurved than the descriptions would lead one to believe; they are slightly more spreading than the body of the leaf. Williams' plants have some leaves slenderly long-acuminate. His fruiting plants all seem to be *M. Careyana*.

Myurella means little mouse tail and Limpricht describes this species in appearance like a string of pearls (perlschnurartig).

M. julacea scabrida approaches this species, but may be distinguished by the lighter, more glaucous color, the more serrulate leaf margins and the more strongly papillose leaf cells.

Drummond's Musc. Am. no. 220 (*Hypnum moniliforme*) seems to have included both this and the preceding species. Both were also collected at Wrangel Bay in the Arctic, according to Bryhn.*

3. MYURELLA CAREYANA Sull. Mosses U. S. 61. *pl.* 5. 1856.

†*Myurella gracilis* (Weinm.) Lindb. in Medd. Soc. p. Faun et Fl. Fenn. 13: 354. 1886.

Hypnum gracile Weinm. in Syll. M. Frond. 1845: 46. 1845.

Plants slender, small, in dense cushions or loose mats, sometimes 15 mm. or more thick, light to glaucous-green; stems erect to ascending, stoloniferous, bushy-branched; branches often flagelliform at the end, julaceous, brittle when dry, 5–10 mm. long; leaves loosely imbricate to erect-open, rather distant, occasionally closely imbricate and simulating *M. julacea* in gross appearance, reaching 0.6 mm. in length, usually shorter, broadly round-ovate to subcircular, strongly narrowed to the insertion, rather abruptly apiculate to slenderly acuminate, very concave; margins *spinose-dentate from base to apex*; costa short or lacking; median leaf cells rounded-rhombic, $\pm 10 \mu$ wide, 1.5–2 : 1, pellucid, each with a *very large dorsal papilla over the lumen*; basal and apical cells elongated and nearly smooth. Seta less than 1 cm. long; capsules suberect and nearly symmetric, oblong-ovoid, urn with neck about 1 mm. long; operculum conic; peristome perfect hypnaceous with two cilia shorter than the teeth. Type from New England.

ILLUSTRATIONS:—Sull. Icones Musc. *pl.* 83; *Pl.* 51.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 250, (Ed. 2) 373; Aust. Musc. Appal. 265; R. & C. Musc. Am. Sept. 234b; Grout, N. Am. Musc. Pl. 205.

In crevices and hollows of limestone rocks in damp shaded places; Nova Scotia to the Yukon, south to North Carolina, Tennessee and Iowa. William's specimens from the Yukon, identified as *M. apiculata* in fruit, is this species. The capsules are empty and almost bell-shaped. While the species is common in limestone regions, spores are very rarely produced.

4. MYURELLA SQUARROSA n. sp.

Plantae laxae caespitosae; caulis suberectus, 2–3 mm. longus; folia patula vel squarrosa, ovata, praeerupte acuminata, plus minusve distincte costata.

Plants in thin light-green mats; secondary stems and branches very short, 2–3 mm., suberect; *leaves spreading to squarrose from a subclasping, broadly ovate base*, rather abruptly acuminate, reaching 0.6 mm. in length, *acumination about 1/2 the leaf length*, strongly narrowed to the insertion, nearly entire to subserrulate with projecting cell angles, smooth or faintly papillose dorsally in the upper leaves; costa short and rather faint to stouter and reaching the leaf middle; median leaf cells irregularly oblong to oblong-rhomboidal, at basal angles a large area of smaller, quadrate to short-rectangular cells; perichaetial leaves subclasping, the inner slenderly long-acuminate. Seta 4–6 mm. long, smooth; capsules oblong-cylindric, with long-conic operculum ± 1.6 mm. long, mostly slightly inclined and nearly symmetric when moist, when dry inclined to drooping and somewhat curved; annulus ?; peristome perfect hypnaceous, with segments as long as the teeth and one or two well developed cilia; spores in late spring. Type on trees, Franklin Co., Nebraska, May, 1899, Coll. J. J. Sheldon, comm. K. Wolfe.

This plant was originally determined as *M. apiculata* by the author and confirmed by Dr. Best, but the characters emphasized above and its habitat on trees make it clearly distinct after a careful comparison with European material.

*Förh. Vid.-Selsk. Christ. 1908²: 21. 1908.

†There were two species named *Hypnum gracile* before Weinmann's. This seems to rule out *gracilis* as a specific name for this species.

10. THELIA Sull. Mosses U. S. Go. 1856.

Plants rather slender, often densely cespitose, sometimes in thinner closely interwoven mats; stems usually creeping and ascending at the ends, branching more or less regularly pinnate; branches short, erect to ascending, strongly julaceous, obtuse, *light to glaucous-green*; paraphyllia various; leaves densely imbricate even when moist, broadly rounded-ovate, very concave, abruptly subulate-acuminate, more or less decurrent; margins nearly plane, mostly ciliate-serrulate, ciliate to lacinate below; costa single, reaching the leaf middle, or short or forking; median leaf cells rhombic to fusiform, each bearing dorsally an enormous papilla, which is simple or forked; median basal and the apical cells elongate, some without papillae. Dioicous; seta smooth, 5-15 mm. long; capsules erect and symmetric, oblong to cylindric; annulus lacking; peristome whitish, the teeth very slender; inner peristome a basal membrane with segments very rudimentary or lacking; operculum conic-rostrate; calyptra smooth, cucullate. Type species, *T. hirtella*.

KEY.

- | | |
|--|----------------------|
| 1. Dorsal leaf papillae single pointed | 1. <i>hirtella</i> . |
| Dorsal leaf papillae with two or more points | 2. |
| 2. Plants growing mainly on bark of trees, most leaves with ciliate margins | 2. <i>asprella</i> . |
| Plants growing mainly on sand and rocks; most leaves without ciliate margins | 3. <i>Lescurii</i> . |

1. THELIA HIRTELLA (Hedw.) Sull. l. c.

Pterigynandrum hirtellum Hedw. Sp. Musc. 83. pl. 17, f. 1-6. 1801.

Thelia robusta Duby, Flora, 58: 284. 1875.

Thelia compacta Kindb. Ottawa Nat. 4: 62. 1890.

Light green to slightly glaucous, in thin, interwoven, loosely adherent mats; primary stems creeping, reaching 5 cm. or more in length, often regularly pinnately branched with numerous short (2-5 mm.) crowded, julaceous branches; leaves broadly ovate to subcircular, strongly concave, abruptly and narrowly acuminate, decurrent, spinulose-dentate above and fimbriate-ciliate below; costa reaching the leaf middle; leaf cells, except the apical and median basal, rhomboidal to fusiform, each with a single long, slender and unbranched papilla on the dorsal surface; apical cells linear, basal elongated, alar subquadrate; perichaetial leaves narrower and more strongly fimbriate-ciliate. Seta 5-10 mm. long; capsule oblong-cylindric; urn 2-2.5 mm. long; peristome teeth noticeably whitish; inner peristome a membrane about $\frac{1}{3}$ the length of the teeth; spores in autumn. Type locality, Lancaster, Pennsylvania.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 80; Pl. 49.

EXSICCATI:—Drumm. Musc. Am. S. States 90 (as *Pterogonium*); Sull. Musc. Allegh. 85; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 247, (Ed. 2) 390; R. & C. Musc. Am. Sept. 191; Grout, N. Am. Musc. Pl. 155, 22; Aust. Musc. Appal. 262.

On bases and trunks of trees in woods; New Brunswick to Nebraska, south to the Gulf; very common in the southern portion of its range.

2. THELIA ASPRELLA Sull. l. c.

Leskea asprella Bry. Eur. Mon. 2. 1850. (name only)

Similar to the last but more markedly glaucous-green, usually in much thicker mats or cushions, reaching 2 cm. in thickness; branching less regularly pinnate; leaves bordered with rather longer cilia; papillae 2-3 pointed. Habitat much as in the last and not rarely growing with it. Type locality, eastern U. S.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 81; M. H. M. pl. 60.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 248, (Ed. 2) 371; Aust. Musc. Appal. 263; Grout, N. Am. Musc. Pl. 33; Musci Perfecti 142; R. & C. Musc. Am. Sept. 84 & 84c.

New England to Ontario and Minnesota, south to the Gulf. Less frequent than the preceding, especially in the northern part of its range.

*3. THELIA LESCURI Sull. l. c.

Subspecies or variety of the last and intergrading with it; typically whitish and more glaucous in color; stems shorter and subfasciculately branching, leaves inclined to be deltoid-ovate and more shortly acuminate, less distinctly ciliate on the margins in majority of leaves; dorsal leaf papillae 3-4 pointed; capsules averaging longer, urn reaching 3 mm.; membrane of inner peristome longer with segments more or less apparent.

ILLUSTRATIONS:—Sull. *Icones Musc. pl. 82; Pl. 49.*

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 249, (Ed. 2) 372; Aust. Musc. Appal. 264; Grout, N. Am. Musc. Pl. 14; R. & C. Musc. Am. Sept. 191.*

In sand or on flat rocks or ledges, often in the open, rarely on trees; New England to Wisconsin, south to the Gulf; more abundant southwards.

Subfamily ANOMODONTEAE.

Plants mostly large and coarse; a few slender and subfiliform; paraphyllia usually lacking; leaf cells very small and dense, rounded to subhexagonal, densely papillose over the lumen (except *Herpetineurum*); capsules erect and symmetric or nearly so; peristome of 16 slender teeth; inner peristome of a short basal membrane, often with rather short slender segments; cilia usually lacking.

11. HERPETINEURUM (C. Muell.) Card. Beihefte Bot. Centralbl. 19²: 127. 1905.

Anomodon sect. *Herpetineuron* C. Muell. *Flora* 73: 495. 1890.

Plants moderately robust, dark green; secondary stems simple to several times divided, densely foliate; paraphyllia lacking; leaves 5-ranked, strongly and irregularly serrate above; costa strong, not percurrent, flexuous, smooth; leaf cells small, not papillose. Dioicous; sporophyte much as in *Anomodon*. Type species, *H. toccoeae*.

HERPETINEURUM TOCCOAE (Sull. & Lesq.) Card. l. c. 128.

Anomodon toccoeae Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 240. 1856.*

Anomodon devolutus Mitt. *Musc. Ind. Or. 127. 1859.*

Neckera (Papillaria) sciuroides Hampe, *Enum. Musc. Brasil. 43. 1879.*

Anomodon (Herpetineuron) flagelligerus C. Muell. *Nuov. Giorn. Bot. Ital. n. s. 4: 273. 1897.**

Plants loosely caespitose; secondary stems little divided, 2–3 cm. long, sometimes flagelliferous with slender narrowly acuminate leaves; normal secondary stems often subcircinnate; leaves rather irregularly imbricate when dry, erect-spreading and often somewhat secund when moist, ovate-lanceolate, concave and slightly plicate at base with margins reflexed, a little more than 2 mm. long, usually somewhat unsymmetric and curved to one side; margins plane and strongly serrate above; costa strong, markedly flexuous above, ending in or near the apex; leaf cells very small, nearly uniform in size, 6–7 μ in diameter, dense and thick-walled but not papillose, mostly rounded-quadrate, sometimes with an oval or oblong lumen; upper perichaetial leaves lanceolate, gradually narrowed to a long filiform acumination, costate. Seta about 2 cm. long; capsule oblong-elliptic, \pm 3 mm. long, erect and symmetric; operculum acutely conic; annulus present; teeth of outer peristome well developed; segments linear, less than half the length of the teeth, attached to a narrow basal membrane. Sporophytes unknown from N. America. Type locality, Toccoa Falls, Georgia.

ILLUSTRATIONS:—Sull. *Icones Musc. pl. 76a: Pl. 56.*

EXSICCATI:—Sull. & Lesq. l. c. & (Ed. 2) 363; Grout, *N. Am. Musc. Pl. Suppl. 32.*

On rocks, North Carolina, Georgia, Florida and Louisiana, also in Asia, the East Indies, Africa and South America.

12. ANOMODON Hook. & Taylor, *Musc. Brit. (Ed. 1) 79. 1818.*

Plants mostly dark green in rather dense mats or cushions, rather large and coarse, often brownish or ochraceous below; primary stems creeping and adhering to the substratum, nearly leafless, sending up secondary stems in large numbers; branches sometimes flagelliform; paraphyllia lacking; leaves brittle, close, usually equally spreading in 5 rows, subclasping at base, lingulate from an ovate base in most of our species, little or not at all decurrent; margins plane and entire; costa strong, in most cases ending below the apex; median leaf cells small, rounded-hexagonal, densely papillose on both sides with papillae rarely single, often double-pointed, only the median basal elongated and smooth. Dioicous; setae elongated, smooth; capsules erect and symmetric, oblong-cylindric, rarely slightly curved, not narrowed below the mouth when dry and empty; peristome teeth narrowly linear-lanceolate; inner peristome of rather short linear segments from a low basal membrane; cilia usually lacking, sometimes rudimentary; operculum conic to rostrate; calyptra cucullate, small. Type species, *A. viticulosus*.

Anomodon californicus Lesq. is a *Triquetrella*, *T. californicus* n. comb. I am indebted to Mr. H. N. Dixon for the identification. He has also compared it with the type of *T. ferruginea* (Schimp.) Thér., which is near it but distinct.

* For full synonymy see Salmon, *Journ. Bot.* 39: 363. 1901.

KEY.

1. Secondary stems and branches slender, usually julaceous when dry. 2.
 Secondary stems and branches coarse, scarcely julaceous. 3.
2. Leaves slenderly acuminate, ending in a hair point; plants growing at base of trees and about ledges. 5. *rostratus*.
 Leaves narrowly lingulate from an ovate base, obtuse to apiculate; plants growing on bark of trees as a rule. 6. *tristis*.
3. Secondary stems much branched as a rule, many branches attenuate to flagelliform; many of the leaves apiculate and toothed at the apex. 4. *attenuatus*.
 Secondary stems more sparingly branched, no attenuate branches. 4.
4. Upper portion of leaves lingulate-lanceolate, conspicuously tapering to the apex, somewhat contorted and crisped when dry, often secund; plants usually growing on rocks. 1. *viticulosus*.
 Upper portion of leaves lingulate and of nearly equal breadth, not secund; plants nearly always growing on bark of trees, stumps or logs. 5.
5. Leaves somewhat crisped when dry with points incurved, not decurrent, having large fimbriate-papillose auricles, often apiculate. 3. *Rugelii*.
 Leaves scarcely contorted when dry, somewhat irregularly appressed, decurrent, without auricles, not apiculate. 2. *minor*.

1. ANOMODON VITICULOSUS (L. Hedw.) Hook. & Tayl. Musc. Brit. (Ed. 1) 79. pl. 22. 1818.

Neckera viticulosa Hedw. Sp. Musc. 209. pl. 48, f. 4-5. 1801.

Our largest species, in wide thick tufts, dark green above, brownish below; secondary stems 4-10 cm. long, often two or three times divided, sometimes appearing bent by reason of innovations, very sparingly branched; central strand present; leaves of secondary stems larger above, reaching 3 mm. long, often more or less secund or subfalcate, contorted, scarcely crispate when dry, *lingulate-lanceolate* from an ovate base, at apex *obtusely acute*, sometimes crenulate; costa strong reaching to near the apex, pellucid; leaf cells rounded-hexagonal to rounded quadrate, about 9 μ in diameter, densely papillose on both sides, opaque and indistinct; at median base an area of elongated less dense cells; inner perichaetial leaves ovate at base, long linear-acuminate above. Seta 12-20 mm. long; capsule usually erect and symmetric, cylindric to oblong-cylindric; urn 2.4-3 mm. long, wrinkled when dry and empty; operculum conic-rostrate, 0.75 mm. long; annulus present; segments of inner peristome as a rule rather better developed than in the two following species, $\frac{1}{2}$ - $\frac{3}{4}$ the length of the teeth; spores in winter, infrequently produced. Type locality European (near Giessen, collected by Dillenius).

ILLUSTRATIONS:—Bry. Eur. pl. 476; M. H. M. f. 136.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 359; Sull. Musc. Allegh. 73; Aust. Musc. Appal. 278. Mostly on shaded rocks, less frequently on bases of trees; Lower Canada and eastern U. S. east of the Mississippi, south to Virginia. Widely distributed but rare and local, apparently calciphile.

Var. MICROPHYLLUS Kindb. Laubm. Schwed. & Norw. 1883.

Dr. Best so identified N. Am. Musc. Pl. 340. Limpricht says of it: a depauperate form, densely tufted, much branched and with smaller leaves.

2. ANOMODON MINOR (P. B.) Lindberg, Fauna & Flora Fenn. 9: 267. 1882.*

Neckera viticulosa var. *minor* Hedw. Sp. Musc. 210. pl. 48, f. 6-8. 1801.

Neckera minor P. B. Prod. 78. 1805.

Anomodon obtusifolius Br. & Sch. in Hook. London Journ. Bot. 2: 668. 1843.

Plants in wide loose mats; secondary stems simple or sparingly divided, 2-4 cm. long, densely foliate; central strand present, consisting of small cells; leaves of secondary stems usually more or less two-ranked, appressed when dry, spreading when moist, reaching 2 mm. in length, somewhat decurrent, broadly lingulate and rounded-obtuse from an ovate base, thick and opaque, densely papillose on both sides with small papillae; costa strong, vanishing below the apex; leaf cells small, 9-12 μ in diameter, rounded-hexagonal;

* Fuenrohr, Flora 12²: Ergaenz. 49. 1829, did not make the combination. He merely assigned a list of species of *Neckera* to *Anomodon*.

median basal elongated, clear, slightly or not at all papillose; perichaetial leaves sheathing. Seta about 1 cm. long; capsules erect and symmetric, with operculum 2-3 mm. long; annulus present, well developed; operculum slenderly conic to rostellate; segments of inner peristome very short to lacking, from a very low basal membrane; spores in late fall or winter. Type locality, eastern North America (Muhlenberg), probably Pennsylvania.

ILLUSTRATIONS:—Sull. *Icones Musc. pl.* 74; Hedw. l. c.; M. H. M. *pl.* 59; Jennings, *Mosses of Western Pa. pl.* 34.

EXSICCATI:—Drumm. *Musc. Am.* 163; Sull. *Musc. Allegh.* 74; Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 283, (Ed. 2) 360; Aust. *Musc. Appal.* 275; R. & C. *Musc. Am. Sept.* 88; Grout, *N. Am. Musc. Pl.* 63.

Usually on bases of trees in moist woods, occasionally on rocks; New Brunswick to Florida and Texas, west to South Dakota.

Distinguished from *A. viticulosus* by its smaller size, less contorted leaves with a broader lingulate upper portion and less developed inner peristome. Any *Anomodon* with any of the leaves acute, apiculate or serrulate at apex is pretty surely not this species.

3. ANOMODON RÜGELII (C. Muell.) Keissl. Ann. Hofmus. Wien 15: 214. 1900.

Hypnum Rugelii C. Muell. *Syn.* 2: 473, & *Leskea apiculata* Schimp. in litt. 1851.

Anomodon apiculatus Bry. Eur. fasc. 44-45. 1850 (name only).

In many respects resembling *A. minor*, compared as follows: secondary stems 2-6 cm. long; *leaves crispate when dry*, not decurrent but with *large rounded, fimbriate-papillose auricles*,* the shorter, broadly ovate base more abruptly narrowed to the lingulate portion, shorter, 1.5-1.8 mm. long, less opaque with larger papillae, often apiculate and often with apex incurved, upper margins often more or less incurved, sometimes serrulate at apex. Seta \pm 1 cm. long, capsule a little longer and more slender, longitudinally wrinkled when dry and empty; annulus lacking; spores in autumn, infrequently produced. Type locality, Smoky Mts., Tennessee (Rugel).

ILLUSTRATIONS:—Sull. *Icones Musc. pl.* 75; Jennings, *Mosses Western Pa. pl.* 34; M. H. M. *f.* 135, p. 258.

EXSICCATI:—Drumm. *Musc. Am.* 163 (as *A. viticulosus*); Aust. *Musc. Appal.* 277; Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 237, (Ed. 2) 358; Grout, *N. Am. Musc. Pl.* 486.

On shaded rocks bases of trees and old logs in cool moist woods, mostly in elevated regions; New England to Michigan, south to Georgia, rather rare.

4. ANOMODON ATTENUATUS (Schreb., Hedw.) Hueben. *Muscol. Germ.* 562. 1832.

Leskea attenuata Hedw. *Sp. Musc.* 230. 1801.

Plants in loose wide mats; secondary stems usually shorter than in the preceding species, abundantly branching with many branches slender to flagelliform; ends of stems and larger branches often blunt and curved when dry; central strand lacking; leaves appressed and often somewhat contorted when dry, rarely, if ever, crisped, spreading when moist, sometimes secund, 1-1.8 mm. long on the main stems and branches, broadly ovate at base, gradually or abruptly narrowed to an upper sublingulate portion, which is proportionately much shorter than in the preceding species, narrowed to the insertion, usually rounded-apiculate or subacute at the apex, mostly somewhat serrulate near the apiculus; costa strong, ending near the apex; leaf cells densely papillose on both sides, obscure, irregularly hexagonal to rounded-quadrate, 6-9 μ in diameter; median basal elongated and less opaque. Setae 1.5-2 cm. long; capsules cylindric, erect and symmetric or nearly so; urn 2-3 mm. long; annulus narrow or lacking; operculum rostrate, about $\frac{1}{2}$ the length of the urn; segments of inner peristome filiform, nearly as long as the teeth; spores in autumn. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 475; Jennings, *Mosses Western Pa. pl.* 34; M. H. M. *f.* 137.

EXSICCATI:—Drumm. *Musc. Am.* 226 (as *Hypnum*), S. States 103; Sull. *Musc. Allegh.* 61 (as *Leskea*); Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 239; Aust. *Musc. Appal.* 274; R. & C. *Musc. Am. Sept.* 87; Grout, *N. Am. Musc. Pl.* 36, 36a and 262.

Mostly on shaded rocks, occasionally on bases of trees; eastern Canada to British Columbia, south to Florida, Louisiana, Missouri and Arizona. Our most common species.

* The characteristic fimbriate-papillose auricles remain on the stem when the leaves are removed unless great care is taken. The decurrent basal angles of the next frequently bear large branched papillae, but they are much less conspicuous in that species.

Occasional diminutive, freely branching forms are found that are almost worthy of varietal rank, but these have the crispate leaves and fimbriate auricles.

5. ANOMODON ROSTRATUS (Hedw.) Schimp. Syn. (Ed. 1) 488. 1860.

Leskea rostrata Hedw. Sp. Musc. 226. pl. 55. 1801.

Plants more slender than the other species (except *tristis*), growing in dense yellowish green mats, the slender julaceous secondary stems and short branches (about 4 mm. long) appearing like the pile of a coarse velvet; primary stems creeping, irregularly branched; central strand present, small; leaves densely imbricate, concave and ovate at base, narrowly lanceolate-acuminate above, ending in a long hyaline piliferous apex, 0.75–0.9 mm. long, crenulate-papillose on the more or less recurved margins; costa strong, ending a little below the apex; leaf cells rounded-hexagonal to rounded-quadrate, opaque and with several papillae on each surface, the marginal 8–10 μ in diameter, the median more elongated; median basal elongated, less dense and slightly or not at all papillose; perichaetial leaves reaching 2 mm. in length, ecostate, the inner with a long filiform acumination which is often $\frac{1}{2}$ the length of the leaf. Seta 6–10 mm. long; capsule ovoid to oblong-ovoid, erect, symmetric, chestnut-colored; urn 1–2 mm. long; operculum obliquely rostrate, about $\frac{1}{2}$ the length of the urn; annulus present; segments of inner peristome nearly as long as the teeth, from a basal membrane $\frac{1}{3}$ the height of the teeth; spores in autumn. Type locality, Lancaster, Pennsylvania.

ILLUSTRATIONS:—Bry. Eur. pl. 473; M. H. M. f. 138; Jennings, Mosses Western Pa. pl. 34.

EXSICCATI:—Drumm. Musc. Am. 288 and 79 (*Pterogonium hirtellum* Hedw.), S. States 104 (as *Leskea*); Sull. Musc. Allegh. 63; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 244 (as *Leskea*), (Ed. 2) 366; Aust. Musc. Appal. 272; R. & C. Musc. Am. Sept. 86; Grout, N. Am. Musc. Pl. 102, Musci Perfecti 155.

Moist places around the bases of trees and ledges, very common in the northeastern U. S. & eastern Canada, south to the Gulf, west to Arizona and Colorado; reported from Vancouver Id. by Macoun.

6. ANOMODON TRISTIS (Cesati) Sull. Mosses U. S. 58. 1856.

Leskea tristis Cesati in De Not. Syllab. Musc. 67. 1838.

Haplohymenium triste (Cesati) Kindb. [according to Brotherus, Engler & Prantl, Musci, (Ed. 1) 986.*]

Leskea fragilis Hook. & Wils. in Drumm. Musc. Am. S. States 101. 1841.

Plants slender, about the size of the smaller *Leskeas*, dull green, in thin loosely interwoven mats; stems prostrate or pendent, irregularly divided, irregularly to subpinnately branching; branchlets erect to ascending; leaves appressed when dry, squarrose when moist, 0.5–0.8 mm. long, very brittle and often broken except at the tips of the stems and branches, exceedingly variable in outline in the species and even on different parts of the same plant; stem leaves lanceolate from an ovate clasping base, broadly acute to very slender at apex, often a hyaline filament at the apex; branch leaves narrowly lingulate and usually apiculate to lanceolate, from an ovate base, crenulate on the margins by the turgid bulging papillose cells, apex rounded to apiculate; costa ending about the leaf middle, rough at back with large papillae; median leaf cells rounded polygonal, almost isodiametric, turgid, with several papillae on each surface, 10–15 μ in diameter, smaller at the margins, a few basal cells near the costa elongated and nearly or quite smooth; spores not found in N. America. Type locality, Italy.

ILLUSTRATIONS:—Jennings, Mosses Western Pa. pl. 34; Broth. Engler & Prantl, Musci (Ed. 1) f. 716; Roth, Europ. Laubm. 2: pl. 35; Moenk. Laubm. Europ. f. 153a; Pl. 57.

EXSICCATI:—Drumm. l. c., Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 241, (Ed. 2) 363; R. & C. Musc. Am. Sept. 195; Grout, N. Am. Musc. Pl. 195.

Mostly on bark of trees and shrubs, occasionally on rocks; Nova Scotia to South Carolina, west to Minnesota; infrequent and local. Most authors state that the leaves are mostly narrowly lingulate above. While this is true of some specimens, the stem leaves of most specimens examined, Italian as well as American, are lanceolate to subulate above and often slenderly acute. A specimen from Snake Mt., Vermont, on limestone in the Champlain water shed, has no lingulate leaves except on the smaller branches; lingulate leaves when present are usually apiculate.

* *Haplohymenium* Dozy & Molk. M. Frond. Arch. Ind. 125. 1854. is the same as *Haplohymenium* Schwaegr. Suppl. 3^d, section 1, pl. 271. 1829, whose type species is the moss now known as *Platygyrium repens* (Brid.) Bry. Eur., with which *Leskea tristis* Cesati is not congeneric. The species placed in *Haplohymentium* by Brotherus, l. c. apparently do not properly belong in *Anomodon* but the nomenclature is so tangled that action of an international committee seems necessary to settle the matter. The author accordingly hesitates to add to the confusion by proposing a new generic name.

KEY TO THE LESKEACEAE.

1. Costa short or double or both..... 2.
Costa strong, reaching the middle of the leaf at least..... 4.
2. Stem leaves subclasping, cordate, decurrent, erect-spreading to spreading-recurved when dry; capsules curved; peristomes perfect..... 4. *Heterocladium*.
Stem leaves not cordate and clasping, appressed when dry; capsules erect or nearly so..... 3.
3. Plants dark green; peristomes much reduced, the inner of very short fugacious segments..... 8. *Pterigynandrum*.
Plants glaucous-green; peristomes perfect..... 9. *Myurella*.
4. Robust plants (except *Anomodon tristis* and *A. rostratus*), without paraphyllia; leaves densely papillose and subopaque; capsules erect and symmetric; peristome with segments narrow and cilia rudimentary or wanting; archegonia on the branches..... 12. *Anomodon*.
Plants small to robust; paraphyllia mostly present; capsules and peristomes various; archegonia mostly on the stems..... 5.
5. Leaf cells smooth, strongly serrate; plants very rare..... 11. *Herpetineurum*.
Leaf cells papillose, or if smooth, leaves not serrate..... 6.
6. Leaf cells with a single very large papilla, which is sometimes forked; capsules erect and symmetric; peristome imperfect, the inner rudimentary or lacking. 10. *Thelia*.
Leaf cells smooth or with much smaller papillae, 1-5 on each cell..... 7.
7. Plants with abundant filiform paraphyllia, which are usually branched; capsules curved, peristomes perfect..... 8.
Paraphyllia less abundant (except forms of *Pseudoleskea*); capsules various; peristomes with cilia rudimentary or often lacking (except *Claopodium*)..... 9.
8. Paraphyllia felted along the stem and attached to the leaf base..... 2. *Helodium*.
Paraphyllia abundant not felted and not attached to leaf base..... 1. *Thuidium*.
9. Plants not found east of the Rocky Mts.; Thuidium-like, leaf cells papillose; capsules curved and peristomes perfect..... 3. *Claopodium*.
Plants not Thuidium-like; capsules mostly erect and symmetric or nearly so; leaves smooth or papillose; peristomes mostly imperfect, the inner sometimes entirely lacking..... 10.
10. Plants of elevated and northern regions, occurring mostly in the Rocky Mts. and westward; leaves with strongly recurved to revolute margins; capsules mostly inclined and unsymmetric; segments of inner peristome lanceolate, partially developed cilia usually present..... 5. *Pseudoleskea*.
Plants growing mostly east of the Rocky Mts., some extending to the Gulf; leaf margins less strongly recurved; capsules mostly erect and symmetric; segments of inner peristome linear or wanting; cilia rudimentary or entirely lacking..... 11.
11. Leaves ovate-lanceolate, acuminate, spreading to squarrose when moist, with plane margins; peristome teeth blunt; inner peristome of a scarcely perceptible basal membrane..... 7. *Lindbergia*.
Leaves ovate to broadly ovate-lanceolate, obtuse to acuminate, erect-spreading when moist; peristome teeth slender-pointed; segments linear in most species..... 6. *Leskea*.

Family HYPOPTERYGIACEAE.

Plants slender to robust; main stems rhizome-like; secondary stems mostly simple below and pinnately branched or *dendroid above*; branches densely and complanately foliate, with a row of much smaller appressed leaves on the ventral side (amphigastria of authors); leaves two-rowed, unsymmetric, ovate to oblong, mostly bordered; costa simple, constructed of homogeneous cells; leaf cells parenchymatous, mostly smooth, alar not differentiated; archegonia borne on secondary stems and their branches. Capsules exserted, seldom erect, mostly symmetric; exothecial cells collenchymatous; peristome perfect or lacking cilia or teeth or both; calyptra naked. Mostly tropical and subtropical.

* See Lindbergia.

HYOPTERYGIUM Brid. Bry. Univ. 2: 709. 1827.

Leaves with costa ending well below apex; seta well developed; peristome perfect, with cilia.

HYOPTERYGIUM JAPONICUM Mitt. Journ. Linn. Soc. 7: 155. 1864.

Hyopterygium canadense Kindb. Rev. Bryol. 28: 46-48. 1899.

Plants light green; secondary stems unbranched for a greater or less distance below, pinnately and complanately branched above, reaching two or more cm. in height; leaves of secondary stems ovate, gradually short-acuminate, bordered, sharply serrate above; branch leaves broadly ovate, short-acuminate, ± 1.5 mm. long; costa extending $\frac{3}{4}$ length; ventral leaves smaller, rounded-ovate; median leaf cells rhombic-ovoid, $\pm 18 \mu$ wide, about 2 : 1. Dioicous; fruit unknown in America.

ILLUSTRATIONS:—Bryologist, l. c. *pl. 9; Pl. 66.*

Queen Charlotte Island off the coast of British Columbia (Newcombe) (the type of *H. canadense* Kindb.); on rocks among boulders, Egg Harbor, Coronation Island, about 55° N. Lat., A. S. Foster.

The occurrence of this Japanese species in such an unexpected region is probably explained by the Japan Stream. (See Holzinger, Bryol. 17: 44. 1914.)

Family HOOKERIAACEAE.

Plants of *soft, often succulent texture*, small to large, often complanate-foliate; stems mostly without central strand, without paraphyllia or stolons; leaves often margined by narrower cells; *leaf cells smooth, thin, pellucid, mostly parenchymatous, alar not differentiated*; costa lacking or single, occasionally double and reaching beyond leaf middle. Archegonial branch small, with few leaves; capsule exserted, inclined to horizontal, exothecial cells often collenchymatous; seta smooth or rough; peristome double, with cilia often lacking or rudimentary; calyptra conical, mitriform, entire, lobed or laciniate, smooth, papillose or hairy.

KEY TO GENERA.

- | | |
|---|---------------------------|
| 1. Leaves ecostate, scarcely bordered..... | 1. <i>Hookeria</i> . |
| Leaves with double costa reaching leaf middle or farther..... | 2. |
| 2. Leaves bordered; double costa reaching the leaf middle; leaf cells smooth..... | 2. <i>Cyclodictyon</i> . |
| Leaves not bordered; double costa nearly reaching apex; leaf cells papillose..... | 3. <i>Callicostella</i> . |

1. HOOKERIA Sm. in Trans. Linn. Soc. 9: 276. 1808.

Plants large, in wide flattened mats, soft, light green, turning whitish when dry; stems more or less complanately foliate, leafy stems reaching 1 cm. in width; leaves large, soft, ecostate, ovate to ovate-oblong, entire. Seta smooth; capsules inclined to subpendulous; capsule short, ovoid; operculum rostrate; annulus usually present; peristome without cilia. Type species *H. lucens*.

KEY.

- | | |
|---|---------------------------|
| Leaves obtuse; plants of the West Coast..... | 1. <i>H. lucens</i> . |
| Leaves acute; plants found east of the Mississippi valley only..... | 2. <i>H. acutifolia</i> . |

1. HOOKERIA LUCENS (L.) Sm. l. c.

Pterygophyllum lucens Brid. Musc. Recent. Suppl. 4: 149. 1819.

Stems 3-6, or even 10 cm. long; central strand present; leaves complanate, imbricated, little changed in drying, *broadly oval, obtuse*, entire, about 4 mm. long, somewhat decurrent; the dorsal symmetric, the lateral somewhat unsymmetric; median leaf cells oblong-hexagonal, and quite regular, 50-60 μ wide, 2-3 : 1, thin-walled; marginal somewhat longer and narrower; perichaetial leaves few, narrower and much smaller. Autoicous; seta reddish yellow, 1.5-3 cm. long, bent at the top; capsules ovoid to oblong-ovoid, horizontal to pendulous; urn 1.5-2 mm. long; operculum long-rostrate from a high conical base, about $\frac{2}{3}$ the length of the urn, exothecial cells somewhat collenchymatous; stomata numerous in the short neck; calyptra mitrate, scarcely longer than the operculum; peristome perfect hypnaceous except for the lack of cilia, outer basal plates of teeth with fine transverse lines; inner peristome about as long as the outer, with basal membrane more than $\frac{1}{2}$ its height; spores autumn to early winter. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 448; *Pl.* 59.

EXSICCATI:—Grout, N. Am. Musci *Pl.* 16 & 16a; Allen, Mosses Cascade Mts. 88.

On moist shaded ground and stones, occasionally on logs; California to Vancouver Island west of the Rockies.

2. *HOOKERIA ACUTIFOLIA* Hook. in Schwaegr. Suppl. 2^o: 36. *pl.* 163. 1826.*

Pterygophyllum lucens Sull. Musc. Allegh. 58. 1846; not Bridel 1819.

Hookeria Grevilleana Griff. Not. Pl. Asiat. 473. 1849.

Hookeria ? Sullivantii C. Muell. in Lesq. & James Manual 293. 1884.

Pterygophyllum acuminatum Paris, Index Bryol. (Ed. 1) 4: 1051. 1898.

In gross appearance closely resembling the last; leaves about the same length, narrower, oblong-ovate, acute; leaf cells about the same. Dioicous; antheridia in small buds at base of stems; seta 1–2 cm. long; capsule inclined to subpendent, more or less unsymmetrical, urn 1–2 mm. long; operculum rostrate, sometimes equaling the urn; annulus lacking; spores rarely produced, probably in winter. Type locality, Nepal, India (Hooker).

ILLUSTRATIONS:—Mem. Torr. Bot. Club 4: *pl.* 80; *Pl.* 58.

EXSICCATI:—Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 270, (Ed. 2) 401; Grout, N. Am. Musc. *Pl.* 311.

In cool springs and banks of streams on soil and damp stones. Ohio to Pennsylvania and Connecticut, south to N. Carolina and Georgia. Also India, Ceylon and Java; West Indies and South America.

2. *CYCLODICTYON* Mitt. Journ. Linn. Soc. 7: 163. 1864.

Type species *C. laetevirens* (Hook. & Tayl.) Mitt. We have only 1 species.

CYCLODICTYON VARIANS (Sull.) Broth. Engler & Prantl, Musci (Ed. 1) 935. 1907.

Hookeria varians Sull. Proc. Am. Acad. Sci. 5: 285. 1861.

Plants closely intertangled in rather thin mats, light to yellowish green; stems and branches complanate-foliate, leafy stems 2 mm. wide; leaves ovate to ovate-lanceolate, rather gradually narrowed to a short, slender acumination, soft, pellucid, somewhat shrivelled in drying, 1.5–1.8 mm. long; median leaf cells oblong-hexagonal, smooth, $\pm 35 \mu$ wide, 1.5–2 : 1, with a border of a single row of long narrow cells $\pm 8 \mu$ wide; margins entire or sinuate-serrulate, plane; costa double, the limbs widely spreading and reaching the leaf middle. Polygamous; seta reddish, light above and darker below, smooth, 1.5–2 cm. long; capsule oblong to ovoid, inclined to horizontal, with a short neck; urn ± 1 mm. long; operculum conic-apiculate; peristome perfect except cilia lacking, teeth with a light divisional line between the two rows of outer plates in their lower $\frac{2}{3}$, segments markedly papillose; calyptra smooth, very persistent; spores in early winter. Type locality, Cuba, *Plantae Cubensis* (Wright) 88. Type at Harvard. *Pl.* 58.

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 536; Grout, N. Am. Musc. *Pl.* 244.

On moist decaying wood and humus; peninsular Florida, not common.

3. *CALLICOSTELLA* (C. Muell.) Jaegr. & Sauerb. St. Gall. Nat. Gesell. (Adumb. 2: 255). 1874–1875.

Hookeria Sect. *Callicostella* C. Muell. Syn. 2: 216. 1850 (in part).

We have only one species, known from Florida only. There are 90 known species, chiefly tropical. Type species *C. incurva* Hook. & Grev.

CALLICOSTELLA SCABRISETA (Hook.) Jaegr. & Sauerb. l. c. (*C. scabrida* Mrs. Britton, Bryol. 21: 28. 1918.)

Hookeria scabriseta Hook. Musc. Exot. *pl.* 52. 1818–1820.

Hookeria cruceana Lesq. & James Man. 292. 1884.†

The smallest member of the family in our range. Plants dark green, irregularly branched; stems and branches complanate-foliate, with leaves less than 2 mm. broad, obtuse; leaves subcrispate when dry, linguulate to ovate-lingulate, ± 1.2 mm. long, abruptly rounded and apiculate at the apex, dorsal and ventral nearly

* See Bryologist 10: 100–101. 1907.

† Both Mitten, Journ. Linn. Soc. 12: 349 and Brotherus in Engler & Prantl, Musci (Ed. 2) 2: 239, say that *C. cruceana* (Duby) Jaegr. & Sauerb. has a smooth seta. Mr. Williams is of the opinion that N. American specimens labeled *C. cruceana* are either *C. scabriseta* or *C. Merkelii* Hsch.

symmetric, the lateral often strongly unsymmetric; margins plane, serrulate above by projecting cell angles; costa strong and double, the limbs diverging and reaching nearly to apex, often toothed at the upper end; upper leaf cells oblong-hexagonal, $\pm 10 \mu$ wide, 1.5-2 : 1, each with a single papilla over the lumen; basal cells larger, reaching 50μ in length, pellucid; perichaetial leaves much narrower. Seta, reddish, 5-7 mm. long, rough throughout with broad rounded papillae; calyptra smooth, conical, deeply lobed or lacinate at base; capsule small, ovoid to oblong, with a short neck, more or less inclined; urn about 0.8 mm. long; operculum $\frac{1}{2}$ the length of capsule; peristome teeth strongly ridged horizontally between the plates and with a wide subhyaline longitudinal line between them; spores in winter. Type locality, "Caripe," northern Venezuela. Type in Hooker Herbarium at Kew? Pl. 58.

EXSICCATI.—Grout, N. Am. Musc. Pl. 268; Musci Perfecti 246.

On peaty banks and rotten logs in damp shaded places; Florida, infrequent and local.

Family NECKERACEAE.

Primary stems creeping and defoliate; secondary erect, horizontal or pendent, irregularly to pinnately branching, usually complanately foliate; paraphyllia mostly lacking; leaves usually large, ovate-lanceolate, lingulate or cultriform, acute, obtuse or apiculate, ecostate or with a slender costa; leaf cells smooth, short-rhombic to linear, quadrate to roundish on the margins; antheridial and archegonial buds on the secondary stems. Calyptra cucullate, smooth or hairy; capsule immersed or emergent, rarely with a seta longer than the perichaetium, erect and symmetric or nearly so; peristome single or double.

KEY.

1. Leaves ecostate, auricled on one side as in the hepatic *Radula*; sterile only, in this country 2. *Homalia Sharpii*.
Leaves not auricled on one side. 2.
2. Capsule on a long seta; leaves cultriform, not undulate, costate to above the middle 2. *Homalia Jamesii*.
Capsule immersed or exserted on a very short seta; (except *Neckera complanata*); leaves often undulate, costate or ecostate. 1. *Neckera*.

1. NECKERA Hedw. Fund. 2: 93. 1782. & Sp. Musc. 200. 1801.

Eleutera P. B. Prodr. 30. 1805.

Primary stems creeping, often stoloniferous and bearing very small leaves; secondary stems erect to pendent, closely foliate, pinnately or bipinnately branched, stems and branches often flagelliform at the ends; leaves complanate (except *N. gracilis*), often transversely undulate, ovate-lanceolate to oblong or lingulate, frequently unsymmetric; leaf cells mostly incrassate, short and rounded near the apex, linear to linear-oblong near the base; capsules immersed to emergent, or long-exserted, erect and symmetric, ovoid to oblong; operculum more or less rostrate; peristome double, the inner a short membrane with 16 more or less well-developed segments, cilia lacking. Plants usually growing on trees or rocks. Type species, *Neckera crispa* (L.) Hedw.

KEY.

1. Leaves acute to acuminate, or apiculate; costa various; plants of the mountains and the North 2.
Leaves very obtuse, truncate, costate to near the apex; known in our range from Florida only (*Neckeropsis* Reichdt.) 8.
2. Leaves ecostate or nearly so 3.
Leaves with costa reaching the middle or beyond 7.
3. Leaves rounded and usually apiculate at the apex 4.
Leaves acute to acuminate, strongly undulate 6.
4. Leaves undulate 1. *pennata* var. *oligocarpa*.
Leaves not undulate 5.
5. Plants moderately robust; leaves complanate 2. *complanata*.
Plants very slender, filiform; leaves not complanate 3. *gracilis*.

- | | |
|--|-------------------------|
| 6. Leaves entire or slightly denticulate above..... | 1. <i>pennata</i> . |
| Leaves with numerous very slender sharp teeth above..... | 4. <i>Douglasii</i> . |
| 7. Plants very robust, reaching 10 cm. or more in length, frequent in the Northwest and fruiting freely..... | 5. <i>Menziesii</i> . |
| Plants much smaller, 2-3 cm. long, fruit unknown, known from one locality in New Mexico only..... | 8. <i>neomexicana</i> . |
| 8. Leaves transversely undulate when moist..... | 7. <i>undulata</i> . |
| Leaves not transversely undulate when moist..... | 6. <i>disticha</i> . |

I. NECKERA PENNATA (L.) Hedw. Stirp. Crypt. 3: 17. 1792 & Sp. Musc. 200. 1801.

Eleulera pennata Stuntz Bull. Torr. Bot. Club. 27: 205. 1900.

Plants rather large, bright to yellowish green; secondary stems horizontal to pendent, 5-10 cm. long, with branching irregularly pinnate; leafy stems 4-5 mm. wide; branches usually obtuse; leaves and branches in the same plane; leaves complanate, spreading, undulate, ovate-lanceolate, acute to acuminate, unsymmetric, 2-2.5 mm. long; margins plane or one incurved at base, entire or slightly denticulate above; costa lacking or faint and short, single or forked; median leaf cells linear-flexuose, $\pm 7 \mu$ wide, 5-8 : 1, at apex shorter and broader, rhomboidal, at basal angles irregularly quadrate to subrectangular, pellucid or colored; perichaetial leaves long-sheathing, the inner long-acuminate, longer than seta and capsule. Autoicous; seta shorter than the capsule; capsule oblong-ovoid, urn about 2 mm. long, red-brown; operculum conic, short rostrate; peristome teeth narrow, sometimes irregularly divided or clinging together at the tips; segments short and imperfect; calyptra hairless; spores spring to summer, usually produced abundantly.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 440; M. H. M. f. 215.

EXSICCATI:—Drumm. Musc. Am. 161; Sull. Musc. Allegh. 76; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 266, (Ed. 2) 392; Aust. Musc. Appal. 255; Grout, N. Am. Musc. Pl. 11; R. & C. Musc. Am. Sept. 188.

Mainly on trunks of deciduous trees in cool moist woods, occasionally on ledges or cliffs. Rather frequent in the East; North Carolina to southern Canada, infrequent west of the Mississippi. Reported by Macoun from Manitoba.

Var. OLIGOCARPA (Bruch) Grout, M. H. M. 394. 1910.

Neckera oligocarpa Bruch in Hartm. Skand. Fl. (Ed. 5) 338. 1849.

More slender; leaves lingulate to somewhat ovate at base, mostly abruptly rounded and apiculate at apex, which is usually finely and regularly serrulate, ± 1.2 mm. long.

ILLUSTRATIONS:—Bry. Eur. *pl.* 441; M. H. M. f. 216.

EXSICCATI:—Aust. Musc. Appal. Suppl. 528; Grout, N. Am. Musc. Pl. 265; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 268 (as *N. chlorocaulis*), (Ed. 2) 393.

It is rather difficult to determine how the European forms of this species and variety compare with the American. Cardot's Musci Europ. Exsic. represents exactly the author's idea of the variety and matches very closely N. Am. Musci. Pl. 265. Typically, so far as appears, the variety is *slender with leaves which in outline much resemble those of N. complanata*, from which the undulate leaves and immersed capsule easily distinguish it. Specimens which are typically *pennata* in other respects have attenuate branches, and specimens otherwise characteristic of var. *oligocarpa* lack them. Specimens of *pennata* are occasionally as slender as the variety.

The variety *oligocarpa* in a robust form approaching forma *pterantha* has been collected by Bartram (Mosses of Southern Arizona 165, as *N. pennata*), and in New Mexico by Fendler. The variety ranges north in the Rocky Mts. through Colorado and into Canada, eastward with the range of the species. All the specimens examined grew on rocks.

The western plants are more robust, about the size of the eastern *pennata*. The shape of the leaf apex is about the only distinction between *pennata* and its var. *oligocarpa* and this character varies greatly in N. America.

Var. OLIGOCARPA forma PTERANTHA (C. M. & Kindb.) n. comb.

Neckera oligocarpa var. *pterantha* Kindb. in Herb. Can. Geol. Survey.

Neckera pterantha C. M. & Kindb. in Macoun Cat. Can. Pl. 6: 162. 1892.

"Secondary stems nearly simple, about (up to) 1 dm. in length, rigid and robust, erect; one branch of costa often reaching to the middle of leaf; paraphyllia numerous; capsule emergent." (Stuntz, l. c.). Leaves reaching 2 mm. in length.

Type locality, rocks, Hector, B. C., the only locality from which it has been collected.

EXSICCATI: Macoun, Can. Musci, 104, 494, 616.

2. *NECKERA COMPLANATA* (L. Hedw.) Hueben. Musc. Germ. 576. 1833.

Leskea complanata Hedw. Fund. 2: 93. pl. 10, f. 62-65. 1782 and Sp. Musc. 231. 1801.

Eleutera ornithopodioides (Scop. 1760) Stuntz. l. c. 209.

Plants about the size (secondary stems 2-4 cm. long) and appearance of *N. pennata oligocarpa* and with cell structure and outline of leaves very similar; but the leaves are *not at all undulate* and the upper leaf cells are more regular, almost exactly rhombic and there are often lanceolate paraphyllia in the axils of the branches, which are often flagelliform. Dioicous; seta 7-10 mm. long, much longer than the perichaetium; operculum $\frac{1}{2}$ the length of urn or longer; spores in spring. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 444; M. H. M. f. 217.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 267; (Ed. 2) 396; Grout, N. Am. Musci Pl. Suppl. 44. On rocks and trunks of trees in cool shaded places. Rare and subalpine. Mountains of Pennsylvania, New England and eastern Canada; north to Labrador. Tennessee, Sull. & Lesq. l. c.

Considerable herbarium material labeled *N. complanata* is *N. pennata* var. *oligocarpa*, due to the fact that most American *complanata* is depauperate and sterile and the leaves have a similar outline. But the non-undulate leaves are a certain and easy distinction. All American material is sterile.

3. *NECKERA GRACILIS* (James) Kindb. Europ. & N. Am. Bryin. 1: 18. 1897.

Homalia gracilis James, Rep. Reg. N. Y. Univ. 22: 57. 1869.

Plants exceedingly small, slender, irregularly but freely branching, filiform; stems and branches mostly flagelliform at the ends, the larger stems somewhat complanate-foliate, with the leaves a little more than 1 mm. wide, bearing oblong-lingulate leaves about 0.7 mm. long, not undulate, rounded-obtuse or apiculate, slightly serrulate at apex; costa very short and often double; upper leaf cells rhomboidal, $\pm 8-12 \mu$ wide and a little longer; basal longer in the median region, smaller at the margins; sporophyte unknown. Type locality, New York.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. pl. 25; Pl. 62.

EXSICCATI:—Aust. Musc. Appal. 257; Grout, N. Am. Musci Pl. 138.

On rocks, usually in elevated regions, New Jersey, New York and Vermont.

4. *NECKERA DOUGLASHII* Hook. Bot. Misc. 1: 131. pl. 35. 1830.

Eleutera Douglasii (Hook.) Stuntz, l. c. 204.

Plants in loosely intertangled masses, often pendent, yellowish or whitish green; secondary stems 10-20 cm. long, with leaves reaching 5 mm. wide, distantly and irregularly branched; branches long, slender and attenuate; leaves of secondary stems complanate, strongly undulate, oblong to oblong-lanceolate, rather abruptly contracted near the apex to a broad short and *spinose-dentate acumination* (sometimes almost ciliate), somewhat concave with one basal margin broadly inflexed, entire or sinuate-serrulate below, reaching 3 mm. in length; costa faint, short and usually double; branch leaves narrower and more slenderly acuminate, those at the ends of the attenuate branches lanceolate, long and narrowly acuminate, bearing near the apex spinose teeth, which are often recurved and 30-50 μ in length; median leaf cells linear-flexuose, rather thick-walled, 5-6 x 50-75 μ ; those at the base shorter, somewhat porose and often colored; inner perichaetial leaves as long as the seta or even longer, often reaching the middle of the capsule, filiform-acuminate, spinose-serrate above. Dioicous; seta ± 6 mm. long; capsule ovoid to oblong, light to dark brown; urn ± 2 mm. long; operculum rostrate, beak as long as the rest of the operculum; peristome teeth slender, reaching 0.4-0.5 mm. in length; segments very slender, almost as long as the teeth, from a conspicuous basal membrane; annulus lacking; spores in winter. Type locality, northwest coast of N. America (Menzies and others) on bark and trunks of trees near the Columbia River. Pl. 60.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 394; Grout, N. Am. Musci Pl. 56, Musci Perfecti 233; Allen, Mosses Cascade Mts. 84; R. & C. Musc. Am. Sept. 77 & 77b.

On rocks and trunks of trees, San Mateo, California to Alaska, east to Colorado and Idaho.

The spinose-dentate leaf apices enable one easily to distinguish this species from all others.

5. NECKERA MENZIESII Hook. in Drumm. Musc. Am. 162. 1828.

Eleutera Menziesii Stuntz, l. c. 207.

Plants robust, dark to yellowish green, in rather loose masses; secondary stems 10–20 cm. long, rather regularly pinnately branched in one plane; branches often slender and attenuate, sometimes with still more slender branchlets pinnately arranged, branches and branchlets often flagelliform at the ends and frequently with abundant lateral flagella; *stems and branches clothed with abundant lanceolate serrulate paraphyllia*; all leaves strongly undulate, those of the secondary stems and main branches reaching 3.5 mm. in length; oblong-lingulate, rounded and apiculate at apex, concave; margins narrowly revolute below, at least on one side, finely serrulate above, often with *a few slender paraphyllia attached to the basal angles*; leaves of the flagellate branchlets ovate-lanceolate, acute to acuminate; costa well developed, reaching $\frac{3}{4}$ the length of the leaf; median leaf cells linear, incrassate, porose, $\pm 7 \mu$ wide, 30–50 μ long; apical much shorter, oblong to rhomboidal; basal shorter, more incrassate and often colored, at basal angles a few very small subquadrate cells; perichaetial leaves longer than seta and capsule, gradually tapering to a slender \pm denticulate point. Dioicous; seta shorter than the capsule, which is oblong-ovoid, brown, urn ± 2.5 mm. long; operculum long-rostrate, about $\frac{1}{2}$ the length of urn; annulus lacking; peristome teeth slender, ± 0.3 mm. long; segments linear from a narrow basal membrane, as long as the teeth, open between the articulations; spores rough, ripening in winter? Type locality, Rocky Mountains (Menzies).

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. pl. 62; Pl. 61.

EXSICCATI:—Drumm. l. c.; Grout, N. Am. Musci Pl. 18; Allen, Mosses Cascade Mts. 85; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 395.

On rocks and trunks of trees; California, Idaho, Montana, and northwards to Alaska.

Var. LIMNOBIOIDES R. & C. Bot. Centralbl. 44: 422. 1890.

"Plants small, caespitose, soft and dilated, brownish-green; secondary stems but 1–2 cm. in length; habit of a *Limnobium (Hygrohypnum)*; no flagella." (Stuntz, Bull. Torr. Bot. Club 27: 208.)

Type locality, Mt. Hood, Oregon; also rocks, Cascades, Easton, Washington.

6. NECKERA DISTICHA Hedw. Stirp. Crypt. 3: 58. pl. 22. 1794, & Sp. Musc. 201. 1801.

Plants pale green, in loose tufts; secondary stems reaching 5 cm. or more in length, about 3 mm. wide at base, irregularly pinnately branching, with few branches, both stems and branches complanately foliate and attenuate; leaves of stem and larger branches not crowded, somewhat shrunken in drying, *not transversely undulate*; lingulate, *very unsymmetric and subclasping at base, at apex rounded-obtuse, truncate or slightly emarginate*, reaching 2 mm. in length, usually shorter; margins plane, entire or very finely toothed at apex; costa slender but distinct, reaching $\pm \frac{1}{2}$ the length of the leaf, often forking near the end, *at the base twice as far from one margin as the other*; upper leaf cells near end of costa varying greatly in shape and size, irregularly subrectangular to oval-rhombic, $\pm 7 \mu$ wide and rather less than 2 : 1, gradually increasing in length towards the base; median basal linear, reaching 10 μ in width, 4–8 : 1, all marginal cells smaller; at basal angles a few much smaller cells. Synoicous; capsule and seta very short, about the length of the long linear-acuminate, serrulate perichaetial leaves, sometimes longer sometimes shorter; calyptra naked; capsule oblong to oblong-cylindric; urn reaching 1.2 mm. in length; annulus lacking; operculum a little less than $\frac{1}{2}$ the length of urn, conic-rostrate, oblique; peristome teeth linear, very rough; segments very narrow, as long as the teeth, basal membrane very narrow or lacking; spores in winter. Type locality West Indies; Pl. 60.

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 530 (some specimens contain an *Entodon*); Grout, N. Am. Musci. Pl. 478.

On trees and bushes, peninsular Florida, rare. Also in tropical America from Mexico to South America.

7. NECKERA UNDULATA Hedw. l. c. 51. pl. 21. & Sp. Musc. 201. 1801.

Eleutera jamaicensis (Gmel.) Stuntz, l. c. 210.

Plants a little more robust than the last, leafy stems about 4 mm. wide; secondary stems 3–5 cm. long, rather sparingly branched in Florida specimens; leaves about the same size and shape as in the last and costa about the same, *but all leaves strongly undulate transversely*; leaf cells about the same, much less regular than shown in Pl. 61; inner perichaetial leaves long-linear acuminate, toothed above, *longer than the very short*

seta and capsule. Synoicous; *calyptra* with a few hairs; capsule short-oblong to oblong-ovoid, urn between 1.2 and 1.5 mm. long; operculum rostrate, more than $\frac{1}{2}$ the length of urn; annulus lacking; peristome much as in the last but more regular and the teeth smooth; spores in spring.

Type locality Jamaica, W. Indies.

ILLUSTRATIONS:—Hedw. l. c.; Engler & Prantl (Ed. 2) Musci 2: f. 571. p. 187; Pl. 61.

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 529; Grout, N. Am. Musci Pl. 230.

On trees and shrubs, peninsular Florida, Texas; also in Mexico and tropical and subtropical America; widely distributed. The Florida plants appear to be smaller than some of the tropical material.

The plants appear more robust than in *N. disticha*, largely because the leaves spread at a wider angle. The Lesq. & James Manual says "teeth and peristome nodulose, punctulate," but this is not true of some thoroughly matured specimens from Florida but does appear to be true of some S. American material.

8. NECKERA NEOMEXICANA (Card.) n. comb.

Porothamnium (?) *neomexicanum* Card. Rev. Bryol. 37: 8. 1910.

Plants soft dull green; secondary stems 2–3 cm. long; branching irregularly pinnate, branches complanate-foliate, obtuse or attenuate; leaves oblong, more or less unsymmetric, not undulate, broadly and shortly acuminate, acute or even subobtuse, minutely denticulate above or entire, concave, somewhat decurrent; lower margins subundulate and often reflexed, then more or less revolute, sometimes nearly plane on one side; costa rather thin, extending to the middle of the leaf or a little farther; upper leaf cells rhomboidal to oblong-hexagonal, median varying from ovate to oblong and linear, about 12 μ wide, 2.5–5:1; alar cells minute, quadrate or roundish; perichaetial leaves convolute, long-acuminate, ecostate; sporophyte lacking. Type locality Mt. Mogallan, near the west branch of the Gila River, Socorro Co., New Mexico (O. B. Metcalf, 1903). Type in Cardot Herbarium at Paris; cotype in herbarium A. J. G. Pl. 60.

The affinities of this species will remain uncertain until the mature sporophyte is found. Brotherus wrote the author that he was sure it was a *Porothamnium* rather than a *Neckera*. Cardot at first referred it to *Neckera*. With this earlier opinion the author agrees.

2. HOMALIA (Brid.) Bry. Eur. fasc. 44–45. 1850.

Omalia Brid. subgenus of *Leskia* Brid. Bryol. Univ. 2: 325. 1827.

Habit, appearance and leaf structure of *Neckera*; leaves not undulate, sometimes with an incurved oblong lobe on one side of the base; capsule on a long slender seta, mostly erect and symmetric; peristome teeth marked with fine transverse lines on the outer plates at base as in *Hypnum*, inner peristome with a well developed basal membrane, keeled segments and cilia rudimentary or wanting.

KEY.

- | | |
|--|---------------------|
| Leaves costate to above middle, no basal lobe..... | 1. <i>Jamesii</i> . |
| Leaves ecostate, with basal lobe..... | 2. <i>Sharpii</i> . |

1. HOMALIA JAMESII Schimp. Coroll. 100. 1856.

Homalia trichomanoides of the Lesq. & James Manual, 285. 1884; not of Bry. Eur.

Homalia Macounii C. M. & Kindb. in Macoun, Cat. Can. Pl. 6: 163. 1892.

Plants loosely tufted or straggling, shining yellow-green; primary stems slender, stoloniferous with very small leaves, secondary stems slender, reaching 1.5 cm. in length, often short, irregularly branching, complanate-foliate; leaves oblong-cultriform, rounded-obtuse, somewhat curved towards the ventral side, minutely serrulate above, usually less than 1.5 mm. long; costa slender, reaching the middle of the leaf or beyond; lower median leaf cells linear-fusiform, about 7 μ wide; apical and marginal cells broadly rhomboidal, scarcely broader than long. Monoicous; seta slender, red, 1–1.5 cm. long; capsule oblong-cylindric, urn a little more than 1 mm. long erect and symmetric; operculum rostrate; annulus present; peristome as described for the genus; spores in autumn. Type locality, North American, Catskill Mts.?

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 397; Aust. Musc. Appal. 256; Grout, N. Am. Musc. Pl. 37 & 232. Drumm. Musc. Am. 171 (As *H. trichomanoides*).

On moist shaded cliffs and ledges, especially in crevices, in cool elevated regions, Pennsylvania to Newfoundland, west to Washington and British Columbia: frequent but local.

It is very doubtful if the North American plant should be considered distinct from the European; the only constant difference the author has been able to note, is that the leaves in the European plant have a tendency to be somewhat apiculate while the American are rounded-obtuse. The distinctions given in the Lesq. & James Manual are either wanting or insignificant. Limpricht gives the length of leaves in the European plant as 1.8-2 mm. but in a number of English and continental plants the leaves were no larger than in the American. (M. H. M. f. 214.)

2. HOMALIA SHARPII Williams, Bryol. 34: 20. pl. 2. 1931.

"Evidently dioicous; plants with trailing stems 4-5 cm. long, bearing scattered radicles and crowded, more or less erect branches 1 to 2 cm. high, often divided above into short complanate branchlets; branch leaves complanate, ecostate, mostly not quite symmetric, from a narrow base broadly ovate to rotundate above, about 0.6 to 1.2 mm. long, the borders entire or slightly crenulate and flat except at one side of base where they mostly become incurved or bear an oblong lobe sometimes nearly one-third the length of the leaf; leaf cells mostly with thickened walls and rounded angles, the apical cells from roundish or square to short-oblong, about $6\ \mu$ by $6-8\ \mu$, and small short cells extend in the border to the base on one side, the longer cells extending down the middle of the leaf in a rather distinct band, with cells up to $8\ \mu$ wide and $30-50\ \mu$ long, near base with often pitted walls; perichaetial leaves mostly narrowly oblong or spatulate, the larger about 0.8 mm. long, sometimes with acute apex but mostly broadly rounded above and irregularly serrate often one third way down, enclosing 6-8 archegonia with few, slender paraphyses." Pl. 65.

"Type collected on face of rocky ledge, near Agee, Campbell Co., Tennessee, at 1300 ft. by A. J. Sharp, March 20, 1930."

"This species is nearest *H. Targioniana* of India but is a smaller plant, with perichaetial leaves not half as long and more serrate."

The above is quoted from the original description. Mr. Sharp has sent the author sufficient material from the type locality for issue in N. Am. Musci Pl. Suppl. No. 42.

The discovery of this near relative of Asiatic species is one of the most interesting of recent bryological discoveries in North America. The Japanese *Hypopterygium* and the Himalayan *Claopodium pellucinerve* on the West Coast are not so hard to understand as the Asiatic *Herpetineurum* in Georgia and *Homalia Sharpii* in Tennessee, so closely allied to Asiatic forms.

Family METEORIACEAE.

Plants slender to moderately robust; primary stems creeping, filiform; secondary stems mostly pendent, mostly distantly and irregularly pinnate, in some cases almost regularly pinnate, complanate-foliate or with leaves equally spreading on all sides; paraphyllia lacking; leaves mostly symmetric, short- to long-acuminate; costa mostly single and slender, seldom double or lacking; leaf cells prosenchymatous, looser at base, somewhat differentiated at basal angles. Mostly dioicous; archegonial and antheridial buds mostly borne on the branches; seta smooth in our species; capsules mostly small and symmetric; stomata phaneropore; peristome double, of the *Neckera* or *Hypnum* type; opercula mostly rostrate.

KEY TO GENERA (of our N. American forms).

- | | |
|---|--------------------------|
| 1. Leaves squarrose-spreading, not papillose..... | 3. <i>Meteoriopsis</i> . |
| Leaves loosely spreading, papillose | 2. |
| 2. Leaves strongly auriculate..... | 1. <i>Tricholepis</i> . |
| Leaves not auriculate..... | 2. <i>Barbella</i> . |

1. TRICHOLEPIS Kindb. Bot. Centralbl. 77: 52. 1899.

Papillaria C. Muell. Oefv. K. Sv. Vet.-Ak. Förh. 4: 34. 1876.* (not of Dulac. 1864).

We have one species of this large tropical genus, practically all growing on trees. The leaves are cordate or auriculate at the decurrent subclasping base; costa single and slender; leaf cells with several minute papillae over the lumen; seta smooth; capsules exserted; cilia of inner peristome rudimentary or wanting; calyptra hairy.

* *Papillaria* had been used three times before 1876 for genera not belonging to the Musci. Kindberg puts *Tricholepis* in the *Cryphaeaceae* but still retains *Papillaria* under family *Papillariaceae*. He describes *Tricholepis* thus "Kapsel mit hervorragenden Stiele. Peristome doppelt. Haube behaart. Blätter (trocken) wenig angedrückt." "Founded on *Neckera nigrescens* Schwaegr."

1. *TRICHOLEPIS NIGRESCENS* (Sw.) n. comb.

Pterigynandrum nigrescens Sw. Fl. Ind. Occid. 3: 1778. 1806.

Neckera nigrescens Schwaegr. Suppl. 3²: pl. 244. 1828.

Meteorium nigrescens Mitt. Journ. Linn. Soc. 12: 441. 1869.

Papillaria nigrescens (Sw.) Jaegr. & Sauerb. St. Gall. Nat. Gesell. 1874-1875: 169.

Plants in thin intertangled mats, the newer growth bright to yellowish green, the older darker, often almost black; stems creeping, reaching 10-15 cm. in length, sparingly divided, often regularly pinnately branching with short branches, which are usually 1 cm. or less in length, these branches often producing very short branchlets; leaves spreading when moist, erect-open to appressed when dry, close, somewhat plicate when dry, those of the stems triangular-ovate from a strongly cordate-auriculate base, narrowly acuminate, somewhat concave, $\pm 1.4 \times 1$ mm.; margins plane, more or less undulate, nearly entire or finely serrulate at base; costa slender, reaching the middle of the leaf or beyond; leaf cells in the region of the costa linear-flexuose, $6-7 \mu$ wide, $5-8:1$, at the angles almost quadrate, the greater length of the cells seeming to diverge at an angle from the costa instead of running parallel to it, all, except some of the elongated cells near the costa, with 2 or more minute papillae on each side; branch leaves narrower, broadly ovate-lanceolate, less slenderly acuminate; perichaetial leaves few, about $\frac{1}{2}$ the size of the branch leaves. Seta short ± 6 mm. long; capsule erect and symmetric; urn about 0.5 mm. long, short-oblong or ovoid; operculum "subulate"; calyptra split on one side, bearing a few hairs; peristome double; teeth well developed, segments linear, shorter than the teeth, from a narrow basal membrane; spores rarely produced. Type locality, Jamaica.

ILLUSTRATIONS:—Schwaegr. Suppl. 3²: pl. 244; Pl. 63.

EXSICCATI:—Grout, N. Am. Musci Pl. 229.

Common on trees in peninsular Florida, occurs also in Louisiana. Much of the Florida material is Var. *DONNELLI* (Aust.) n. comb. (*Meteorium nigrescens* var. *Donnelli* Aust. Musc. Appal. 533). This is apparently a habitat form, very easily recognized by the more slender branches, denuded of leaves except a small tuft at the very end. This is often mistaken for a sporophyte at first glance.

2. *BARBELLA* (C. Muell.) Fleisch. Engler & Prantl (Ed. 1) Musci, 828. 1906.

Pilotrichella; section *Barbella* C. Muell. Flora 82: 464. 1896.

In so far as our species are concerned this genus differs from the last chiefly in its leaves not cordate or auriculate and its narrowly linear leaf cells. Type species *B. trichophora* (Mont.) Fleisch.

BARBELLA PENDULA (Sull.) Fleisch. l. c., 1227. 1909.

Meteorium pendulum Sull. Mosses U. S. 81. 1856.

Plants yellowish green above, brown in the older parts, long filiform, flexuous and pendent, sometimes reaching 15 cm. or more in length; leaves erect-open, those at the base of branches larger, narrowly lanceolate, gradually and slenderly long filiform-acuminate, ± 2 mm. long, subclasping and slightly decurrent; margins plane, serrulate; median leaf cells narrowly linear $\pm 6 \mu$ wide, reaching $35-40 \mu$ in length, papillose dorsally at least with two or more minute papillae; alar short-rectangular to quadrate, all rather thick-walled; costa reaching the leaf middle. Probably dioicous; seta 2-3 mm. long; capsule ovoid, about 1 mm. long; operculum conic, obliquely short-rostrate; peristome teeth more or less open along the middle line; segments a little shorter, from a low basal membrane.

ILLUSTRATIONS:—Sull. Icones Musci. pl. 73; Pl. 62.

On trees and bushes, western Louisiana. Also in the East Indies, Japan and China.

3. *METEORIOPSIS* Fleisch. Musc. Archip. Ind. Exs. n. 235. 1902.

Differs from our other genera of the family chiefly in the squarrose-spreading leaves and smooth leaf cells.

METEORIOPSIS PATULA (Sw., Hedw.) Broth. Engler & Prantl, Musci (Ed. 1) 2: 825. 1906.

Hypnum patulum Hedw. Sp. Musci. 279. pl. 73. 1801.

Plants light green, in loosely intertangled mats; stems creeping, long, reaching 15 cm. or more in length, more or less regularly pinnate with short (3-6 mm.) branches; stem leaves spreading to squarrose, broadly

round-ovate, strongly contracted to the subclasp, slightly decurrent base, rather abruptly acuminate; margins plane entire or minutely serrulate; costa very slender, reaching about to the leaf middle; median leaf cells narrowly linear, about $6\ \mu$ wide, 6-10 : 1; basal shorter and broader, with thicker walls and often colored; at basal angles a small group of more or less enlarged, subrectangular cells; branch leaves squarrose-spreading, broadly ovate, more shortly acuminate and more strongly serrate; perichaetial leaves ecostate, reaching to the base of the capsule. Capsule ovoid-cylindric, symmetric; operculum subulate-rostrate; peristome teeth narrow, segments narrow, as long as the teeth, from a narrow basal membrane; calyptra somewhat hairy. *Pl.* 57.

Collected by Dr. Small "in hammocks between Cutler and Longview Camps, Florida, Nov. 1903, no. 1374." A specimen without data except that it was from Florida was sent me by B. D. Gilbert in 1904. Also found in the West Indies, Mexico and southwards into South America to the Amazon.

Plants from Haiti, det. and distributed by Renaud, are scarcely pinnate, the stem leaves are very longly and slenderly acuminate, the acumination as long as the body of the leaf and the margins serrate; the branch leaves are long-acuminate and sharply serrate.

Family PTEROBRYACEAE.

Secondary stems with leaves equally spreading, symmetric; costa single and well-developed to short and double or lacking; leaf cells prosenchymatous, mostly papillose in *Pirella cymbifolia*, looser at base. Mostly dioicous; seta smooth; capsule symmetric, immersed or exserted; stomata few, phaneropore; annulus lacking; peristome teeth normally developed or variously irregularly formed; inner peristome mostly rudimentary, segments lacking, short, or filiform, rarely keeled; opercula apiculate to short-rostrate. So far as our species are concerned the species might well be included in the Meteoriaceae, as capsules seem to be unknown. Both families are mostly tropical or subtropical and Broth. & Prantl's classification in the second edition of Engler & Prantl has been followed and the family descriptions adapted from that work. The peristomes in both the genera occurring with us are very imperfect or peculiar, but peristomes are unknown in our species.

KEY TO GENERA.

- | | |
|---------------------------------|---------------------------|
| Leaves squarrose-reflexed | 1. <i>Jaegerinopsis</i> . |
| Leaves erect-spreading | 2. <i>Pirella</i> . |

1. JAEGERINOPSIS Broth. Engler & Prantl, Musci (Ed. 1) 2: 790. 1906.

Plants moderately robust, growing in loose tufts; secondary stems erect, densely foliate; *leaves squarrose-spreading*, concave, smooth; leaf cells linear; peristome simple, deeply inserted under the mouth, teeth short, blunt and jointed, dorsal layer rough with rounded projections. Type species, *J. Ulei* C. Muell.

JAEGERINOPSIS SQUARROSA, E. G. B. Bryol. 21: 48. *pl.* 24. 1918.

Plants bright green, glossy, climbing on trees; primary stems slender, decumbent and rooting, with small appressed bract-like leaves, which are only .5-1 mm. long, lanceolate-acuminate, ecostate, and entire, or with a short faint costa; secondary stems stout, erect, red, simple and unbranched, 1-2 cm. rarely 4-5, long, rarely tapering off into slender flagellate innovations; leaves crowded, spreading, often with septate propagula in their axils, 1.5-2 mm. long x 1-1.33 mm. wide, rarely wider than long, broadly ovate or cordate, carinate or concave; apex variable, acute or acuminate, serrulate, not subulate, often recurved; margins minutely and obscurely serrulate to base, each marginal cell ending in a small tooth; costa variable, single, and broadest at base, or forking at apex, or rarely double and short, usually extending to less than $\frac{1}{2}$ the length of the leaf, rarely $\frac{3}{4}$; basal cells largest, irregular and prorse; alar cells slightly different, denser and yellow or brown with thick walls, median and apical cells narrowly linear-vermicular, 27-54 μ long by 2-4 μ wide; all porose and smooth. Dioicous? only female plants known. Archegonia in small lateral buds about 1 mm. long, with acuminate, serrulate, ecostate leaves and few paraphyses. *Pl.* 65.

Type locality: Sierra de las Yeguas, San Diego de los Banos, Pinar del Rio, Cuba, June 28, 1915. Type in herb. N. Y. Bot. Garden, co-type in herb. A. J. G.

On trees. Conspicuous for the squarrose leaves; known only with female inflorescence.

South Slope of Sierra de los Helechales, Banao Mts., Santa Clara, Bros. Leon and Clement, Aug. 1915. Also on Magnolias near Sanford, Florida, S. Rapp. 1917.

Very closely related to *Jaegerinopsis scariosum* Ltz. from Panama and perhaps identical, but the leaves

of "*Meteorium scariosum* Ltz." from Panama are described as being "shortly bicostate." Our specimens from Cuba and Florida are rarely shortly bicostate or they may have the vein forking either at the base or the apex, but usually it is single and ending in the middle of the leaf.

2. *PIREELLA* Cardot, Rev. Bryol. 40: 17. 1913.

Primary stems creeping; secondary stems 2-4 cm. long, unbranched below and covered with appressed leaves, then thickly branched above with branches mostly in the same plane; lower appressed leaves of the secondary stems ovate, and nearly entire; upper stem and branch leaves strongly costate; median leaf cells linear to oblong, alar often quadrate. Dioicous; capsules mostly immersed, erect and symmetric, ovoid-spheroidal; peristome double, the teeth mostly united in pairs at the top with the bases separate, without lamellae, smooth; inner peristome adherent to the teeth, consisting of a high thin hyaline membrane, which later disappears; operculum small, long-rostrate; calyptra hairy, becoming smooth when old; vegetative reproduction by means of brood bodies common. Growing almost exclusively on trees. Type species *P. cavifolia* (Card. & Herz.) Card.

KEY.

Secondary stems branching rather irregularly, not frondiform; lower leaves of secondary stems not auriculate. 1. *cymbifolia*.
Secondary stems regularly and complanately branching above, simple below, frondiform; lower leaves of secondary stems auriculate. 2. *ludoviciae*.

1. *PIREELLA CYMBIFOLIA* (Sull.) Card. Rev. Bryol. 40: 17. 1913.

Pilotrichum cymbifolium Sull. Mosses U. S. 81. 1856.

Plants in rather straggling patches on trees and shrubs; secondary stems reaching 5 cm. or more in length, almost simple to irregularly and subpinnately branching; branches short, mostly 5-10 mm. long terete-foliate; leaves spirally 5-ranked (according to Sullivant), imbricate; lower leaves of secondary stems broadly oblong-lanceolate, very concave with flat apices, gradually short-acuminate, ± 2 mm. \times 0.5 mm., slightly narrowed to the insertion, *subclasping and slightly decurrent but not auriculate*, nearly or quite entire; median leaf cells linear-flexuose, 4-5 \times 30-40 μ ; basal shorter and broader, often colored, at basal angles a triangular patch of very small quadrate cells (12-20 on the margin), ± 6 μ wide; costa slender but nearly or quite percurrent; branch leaves smaller, more strongly concave, more or less papillose on the back with very fine papillae, serrulate in the upper half; perichaetial leaves much smaller, more slenderly acuminate, ecostate. Sporophyte unknown; apparently reproducing by the septate brood bodies found in clusters in the axils of the leaves. Type locality, Florida; also found in Alabama and Louisiana.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 76; Pl. 56.

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 531; R. & C. Musc. Am. Sept. 44.

2. *PIREELLA LUDOVICIAE* (C. Muell.) Card. l. c.

Neckera ludoviciae C. Muell. Flora 58: 92. 1875.

Differs from the last in the almost regularly pinnate branching of the upper part of the secondary stems, producing a frond-like form; lower leaves of the secondary stems ovate-triangular, strongly auriculate, abruptly long-acuminate; branch leaves with a longer and more slender acumination, nearly entire, little or not at all papillose.

"Capsule elliptic-ovate, erect, tapering at the base, narrowed at the apex, solid, smooth, on a stout minutely roughened pedicel about 12 mm. long; annulus lacking, operculum convex or very short-rostellate; peristome teeth stout and imperfect, linear, hyaline, incurved; calyptra with erect hairs." (Austin, Bot. Gaz. 4: 161. 1879.)

Austin, l. c., states Mueller's diagnosis was on depauperate specimens.

On trees, Florida and Louisiana.

ILLUSTRATIONS:—Pl. 57.

EXSICCATI:—Aust. l. c. 532; Cardot, l. c. 78 (according to E. G. B.); Grout, N. Am. Musc. Pl. 227 (as *Pilotrichella cymbifolia*).

The author thoroughly agrees with Mrs. Britton (Bryol. 7: 49. 1904) that this is a good species distinct from *P. cymbifolia*. In fact fairly well-developed plants can be determined at sight. The plants from the Florida Keys and the Everglades and southern peninsular Florida seem to be mostly *P. cymbifolia*, while those from the northern part of the state are mostly *P. ludoviciae*.

Family LEUCODONTACEAE.

Plants rather robust as a rule; primary stems creeping; secondary stems erect, horizontal or drooping, mostly terete-foliate with crowded appressed leaves, simple or branched; paraphyllia mostly lacking; leaves ovate to ovate-lanceolate, often plicate longitudinally, acute to acuminate, mostly entire or nearly so in our species; costa single, double or lacking; leaf cells thick-walled, short and rounded, smooth (except *Leucodontopsis* and *Pseudocryphaea*). Mostly dioicous; capsules erect and symmetric, ovoid to oblong-cylindric, mostly without stomata, immersed to long-exserted; inner peristome rudimentary or lacking, occasionally attached to the teeth; teeth rarely with fine cross striae on the outer basal plates.

KEY TO GENERA.

- | | |
|--|----------------------------|
| 1. Costa single..... | 2. |
| Costa double or lacking..... | 4. |
| 2. Leaf cells papillose..... | 2. <i>Leucodontopsis</i> . |
| Leaf cells not papillose (obscurely so in <i>Pseudocryphaea</i>)..... | 3. |
| 3. Costa percurrent or nearly so; plants found only in Florida within our range, rare. | 3. <i>Pseudocryphaea</i> . |
| Costa ending well below apex; plants of the northern U. S. | 5. <i>Leptodon</i> . |
| 4. Leaf cells papillose; plants of the West Coast | 4. <i>Pterogonium</i> . |
| Leaf cells smooth; plants of the eastern U. S. and Canada | 5. |
| 5. Secondary stems little branched; calyptra smooth..... | 1. <i>Leucodon</i> . |
| Secondary stems, freely and often pinnately branched; calyptra hairy..... | 5. <i>Leptodon</i> . |

1. LEUCODON Schwaegr. Suppl. 1²: 1. 1816.

Main stems long, slender, creeping, almost filiform, with minute leaves and abundant rhizoids; secondary stems numerous, suberect, horizontal or pendent and curved outwards from the substratum, usually julaceous and nearly simple; paraphyllia lacking; leaves of secondary stems many-ranked, concave, with margins recurved below, appressed when dry, spreading when moist, entire or slightly serrate at apex; leaf cells thick-walled, smooth, several rows of basal-marginal cells roundish-quadrate, the lower median linear fusiform, gradually becoming shorter toward the apex, upper marginal short-oblong; basal often colored. Dioicous; calyptra smooth, cucullate, sometimes attached below the capsule by the connate base; capsules exserted or emergent, erect and symmetric, stomata lacking; peristome apparently simple but in some cases of two layers with cell cavities between, rudimentary and scarcely apparent inner peristome often present. Type species *L. sciuroides*.

KEY.

- | | |
|---|------------------------|
| 1. Leaves ovate-elliptical, abruptly short acuminate, scarcely plicate when dry..... | 3. <i>julaceus</i> . |
| Leaves ovate to ovate-lanceolate, gradually longer acuminate, plicate when dry..... | 2. |
| 2. Secondary stems well developed, rarely with flagella; seta much shorter than the perichaetial leaves..... | 1. <i>brachypus</i> . |
| Secondary stems usually less developed, shorter and usually bearing numerous flagella; seta much longer than the perichaetial leaves..... | 2. <i>sciuroides</i> . |

1. LEUCODON BRACHYPUS Brid. Bryol. Univ. 2: 211. 1827.

Plants in rather loose tufts or patches on trunks of trees, rather dark green above, brown below; secondary stems 5-6 cm. long, sparingly divided or branched, usually drooping and outwardly curved; leaves 1.6-2 mm. long, plicate when dry, more or less secund, especially on the outward curve of secondary stems, ovate to ovate-lanceolate, sharply acute to short-acuminate, often slightly serrulate near apex, ecostate; leaf cells as described for the genus, the median with lumen about 5-6 μ wide, 3-5 : 1, walls a little thinner than width of the lumen; perichaetial leaves loosely appressed-sheathing, longer than the seta. Seta 3-4 mm. long; capsule oblong-ovoid, urn 1.5-2 mm. long, chestnut-colored, small-mouthed; operculum conic-rostrate; peristome teeth somewhat irregular, papillose, often bifid at apex; spores in late autumn or winter. Type from North America.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 70; M. H. M. f. 212 & 213. (in f. 212 *e* represents median and *d* median basal cells); Jennings, Mosses Western Pennsylvania. pl. 31.

EXSICCATI:—Sull. Musc. Allegh. 86; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 232, (Ed. 2) 351; Aust. Musc. Appal. 261 and 260 (as *L. julaceus*). (See Mrs. Britton in Bryol. 21: 32); Grout, N. Am. Musci. Pl. 301.

On trees and occasionally on rocks, in woods in cool elevated regions; northeastern U. S. and eastern Canada, south to Georgia, west to Kansas; frequent, but mostly sterile. Occasionally with branches tapering into long slender, more or less hooked tips and bearing small leaves. (Var. *flagellatus* E. G. B. Mem. Torr. Bot. Club 4: 190. 1894.)

2. LEUCODON SCIUROIDES (L., Hedw.) Schwaegr. Suppl. 1²: 1. 1816.

Fissidens sciuroides Hedw. Sp. Musc. 161. 1801.

Differs from *L. brachypus* in its smaller size (with few exceptions in N. America); secondary stems rarely over 3. cm. long, frequently producing such large numbers of flagelliform branches near the top as to give the plants a deformed appearance; leaves rarely secund, *very strongly plicate whether wet or dry, longly and slenderly acuminate*, entire (with rare exceptions). Capsules long exserted on a seta about 8–10 mm. long, rather longer than in our other species, urn 2.5–3 mm. long; peristome teeth often widely split along the median line, with cell cavities between the inner and outer plates, rudiments of inner peristome present as a narrow membrane not reaching the height of the mouth of the capsule; spores in spring, but the author has never seen sporophytes on N. American plants. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 468; M. H. M. f. 212; Limpricht, Laubm. 2: 685. f. 330; Pl. 66.

EXSICCATI:—Grout, N. Am. Musc. Pl. 81.

On rocks and trunks of trees in cool woods, Southeastern Canada, northern New England, Ontario, Pennsylvania, west to Michigan and Iowa.

Both Cardot and Dixon have pronounced our American plant to be *sciuroides*, though Dixon considered the specimens sent to him as worthy of varietal rank. However, our material differs so greatly that it would be difficult to describe it as a variety.

As a rule the median cells of the upper $\frac{1}{4}$ of the leaf are consistently longer than those of *L. brachypus*, but this is not always the case and occasional specimens are impossible to place with certainty.

3. LEUCODON JULACEUS (Hedw.) Sull. Musc. Allegh. 87. 1846 & Icones Musc. 110. pl. 69. 1864.

Pterigynandrum julaceum Hedw. Stirp. Crypt. 4: 51. pl. 69. 1793 and Sp. Musc. 81. 1801.

Strongly resembling *L. brachypus* but with shorter secondary stems which are *terete-foliate, julaceous when dry*, often stoloniferous at the tips; leaves crowded, closely appressed-imbricate when dry, not at all secund, scarcely plicate, ovate-elliptical, rather abruptly short-acuminate, ± 1.5 mm. long, very concave with reflexed margins except at apex where they are often incurved, serrulate, *mammillose roughened at the back of the apex*; upper median leaf cells with a rather wider lumen than the other two species. *Capsule exserted, the perichaetial leaves scarcely reaching its base*; capsule and peristome about as in *L. brachypus*; spores late fall to winter. Type locality N. Am. (Pennsylvania). The Dillenian specimens were from Pennsylvania and Virginia.

ILLUSTRATIONS:—Sull. l. c.; M. H. M. l. c.; Jennings, Mosses W. Pa. pl. 32.

EXSICCATI:—Sull. Musc. Allegh. 87; Drumm. Musc. Am. S. States 91 (as *Pterogonium*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 231, (Ed. 2) 350; Aust. Musc. Appal. 258, 259; Grout, N. Am. Musci. Pl. 34; R. & C. Musc. Am. Sept. 80 & 80b.

On trees in woods, often mixed with other mosses. Southern New England, southern Ontario, west to Minnesota, south to the Gulf, mostly east of the Mississippi; Oklahoma, Texas, more abundant in the Southern States and fruiting freely.

While the dry leaves are slightly wrinkled, when moist they are free from plications; this and the shorter ovate leaves, nearly always somewhat roughened at the back of the apex, make this species easy to distinguish even when sterile.

Forma FLAGELLIFERUS Grout, Bryol. 26: 30. 1923.

Plants producing numerous long slender flagella bearing small lanceolate leaves which are longly and slenderly acuminate, leaf cells more elongated and with thinner walls. Winston-Salem, North Carolina, P. O. Schallert. Type in herb. A. J. G.* This is not the stoloniferous form mentioned in Bryol. 21: 32.

The slender flagella several mm. long are very different in appearance from those of *L. sciuroides*. The lower leaves approach normal, growing progressively narrower toward the ends of the flagella.

* See *Habrodon*.

2. LEUCODONTOPSIS R. & C. Bull. Soc. Roy. Bot. Belg. 32: (1). 177. 1893.
(*Leucodoniopsis* by typographical error.)

A small genus of 4 tropical or subtropical species whose position is uncertain, as none have ever been found with sporophytes. We have one species, the type species.

LEUCODONTOPSIS FLORIDANA (Aust.) E. G. B. Bryol. 15: 28. 1912.

Neckera (*Pilotrichum*?) *floridana* Aust. Bot. Gaz. 4: 152. 1879.

Leucodoniopsis plicata R. & C. l. c.

Pilotrichella floridana R. & C. Rev. Bryol. 20: 11. 1893.

Plants in loose tufts, light green; primary stems creeping, with small ecostate slenderly acuminate leaves; secondary stems erect or pendent, short, 1-2 cm. long, reminding one of small forms of *Pirella cymbifolia* (except that the leaves are evenly distributed, not in rows), simple or sparingly branched; leaves loosely imbricate and somewhat irregularly wrinkled when dry, erect-open when moist, oblong-lanceolate, very slightly decurrent, ± 1.5 mm. long, concave with margins revolute almost to the apex, slightly serrulate at apex; costa simple, slender, extending about to the leaf middle; median leaf cells linear-flexuose, about 6μ wide, 6-12 : 1, papillose on both faces with one or two low papillae over the lumen; at basal angles a large group of rounded-quadrate to transversely elongated minute cells reaching nearly half-way to the costa; other basal cells short, thick-walled and colored; reproducing by septate brood bodies borne in the axils of the leaves. Type locality Caloosa, Florida. Collected also at Grassy Key (Small) and cypress swamp near Sarasota-Arcadia road (Grout), also in the West Indies and Costa Rica.

ILLUSTRATIONS:—Bryol. l. c. *pl.* 27; *Pl.* 64.

3. PSEUDOCRYPHAEA E. G. B. Bull. Torr. Bot. Club. 32: 261. 1905.*

A monotypic genus.

PSEUDOCRYPHAEA FLAGELLIFERA (Brid.) E. G. B. l. c.

Pilotrichum flagelliferum Brid. Bryol. Univ. 2: 259. 1827.

Leucodon domingiensis Mitt. Journ. Linn. Soc. 12: 409. 1869.

Plants in rather loose tufts; secondary stems simple below, freely branched above, somewhat dendroid in appearance, with branches reaching 5 cm. or more in length, often with numerous slender flagelliform branchlets; median leaves appressed-imbricate when dry, ovate to ovate-lanceolate, concave, slightly decurrent, broadly short-acuminate, ± 1.5 mm. long, sometimes obscurely papillose at back above; margins plane, serrulate above; costa slender, nearly or quite percurrent; median leaf cells in Florida plants, longer and narrower than figured, linear-rhomboidal, about 9μ wide, 5-8 : 1, shorter towards the apex; basal thicker-walled, colored and porose; at basal angles a triangular patch of small quadrate to oblong cells with rounded lumen, reaching nearly to the costa. Capsule ovoid, exserted on a long slender yellow seta, brownish, erect; peristome unknown. Type locality, West Indies.

ILLUSTRATIONS:—Engler & Prantl, Musci (Ed. 2) 2: f. 502; *Pl.* 65.
Collected at 5 stations in Florida; also in Central and South America.

4. PTEROGONIUM [Sw.] Bry. Eur. fasc. 46-47. *pl.* 461. 1851.

Pterogonium Sw. Disp. Syst. Musc. Frond. Suec. 26. 1799.

A monotypic genus of Europe and the west coast of North America.

PTEROGONIUM GRACILE (L., Hedw.) Bry. Eur. l. c.; also Sw. l. c.

Pterigynandrum gracile Hedw. Sp. Musc. 80. 1801.

Grimmia ornithopodioides Web. & Mohr, Bot. Taschenb. 148. 1807.

Plants olive green to brownish, in wide rather loose patches; secondary stems slender, usually unbranched below, 2-5 cm. high, with numerous clustered branches above, often giving the plants a dendroid appearance; branches curved to one side, slender, julaceous when dry with closely imbricated leaves, obtuse

* See citation for complete synonymy.

or elongated and flagelliform; leaves of upper stem and branches ovate, acute to acuminate, decurrent, about 1.5 mm. long, 2 : 1, sharply or even doubly serrate above, concave, excavate at base, papillose above at back by projecting cell angles; costa faint and short or lacking; leaf cells *thick-walled*, irregularly rhomboidal to oblong at apex, $\pm 9 \mu$ wide, 3-4 : 1; median basal elongated, 4-8 : 1; a large area of basal-marginal cells, rounded-quadrate, gradually elongating and merging into the median; leaves of the shorter branches smaller with shorter rounded leaf-cells. Dioicous; seta 10-15 mm. long; capsule erect and symmetric or nearly so, oblong-cylindric, urn 2.5-3 mm. long; operculum conic; annulus large; calyptra cucullate, bearing a few hairs; peristome double, teeth cross-striate with papillae, papillose above; segments short and slender from a narrow basal membrane; spores in autumn. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 467; Limpricht, Laubm. 2: 782. f. 345; *Pl.* 70.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 349; R. & C. Musc. Am. Sept. 316 (as var. *californicum*).

On rocks and bark of trees; California to Oregon east to Ontario. Common in California.

4. LEPTODON Mohr. Obs. Bot. 27. 1803.

Forsstroemia Lindb. Öfv. K. Vet.-Ak. Förh. 19: 605. 1863.

Secondary stems numerous, usually erect, densely foliate, sparingly to pinnately branched; leaves appressed-imbricate when dry, erect-open when moist, ovate to oblong, short-acuminate; costa lacking, short and double or single and well developed; median leaf cells smooth, elliptical to oblong-rhomboidal, the marginal short and rounded. Autoicous in all our species; capsule immersed, exerted or emergent, ovoid to oblong, without stomata; peristome teeth linear-lanceolate, well developed; inner peristome rudimentary or lacking; annulus very narrow or lacking; calyptra cucullate, more or less hairy. Type species *L. trichomitrium*.

KEY.

- | | |
|---|------------------------------|
| 1. Median leaf cells (except close to costa) not more than 2 : 1; costa single and strong, reaching the middle of the leaf or beyond; seta longer than the perichaetial leaves..... | 2. <i>ohioensis</i> . |
| Median leaf cells more than 2 : 1; costa various, or lacking; seta shorter to longer than the perichaetial leaves..... | 2. |
| 2. Basal marginal cells quadrate to transversely elongated..... | 3. |
| Basal marginal cells (except 3-4 at insertion) much longer than broad..... | 3. <i>nitidus</i> . |
| 3. Perichaetial leaves longer than the seta; capsule exerted..... | 1. <i>trichomitrium</i> . |
| Perichaetial leaves shorter than the seta..... | 1a. var. <i>floridanus</i> . |
| Perichaetial leaves reaching nearly or quite to mouth of capsule..... | 1b. var. <i>immersus</i> . |

In the simple peristome and leaf structure this genus seems closer to the *Leucodontaceae* than to the *Cryphaeaceae*.

Lindberg, l. c. proposed *Forsstroemia* (type *F. trichomitria*) to take the place of *Lasia* P. B. Prodr. 25 & 72. 1805, as that was preoccupied, overlooking the fact that Mohr had, in 1803, established *Leptodon*, based on *Pterigynandrum richomitrium* Hedw. & *P. subcapillatum* Hedw. [*Homalotheciella subcapillata* (Hedw.) Cardot] and 9 other species.

Lindberg, Journ. Linn. Soc. 13: 71. 1872, admits this but refuses *L. Smithii* Mohr a place in the genus. It seems to the author that from point of intention as indicated by Mohr's publication, *L. trichomitrium* has a better claim to be the type of *Leptodon* than has *L. Smithii*, which Mohr certainly did not consider the type of his genus *Leptodon*.

1. LEPTODON TRICHOMITRION (Hedw.) Mohr. l. c.

Forsstroemia trichomitria (Hedw.) Lindb. l. c.

Pterigynandrum trichomitrium Hedw. Sp. Musc. 82. *pl.* 16. 1801.

Plants dark- to yellowish-green, growing in rather wide loose tufts; secondary stems freely and sub-pinnately branched, densely foliate; sometimes with flagellate branchlets, leaves of secondary stems somewhat plicate when dry, concave with reflexed borders, ovate to ovate-lanceolate, 1.5-2 mm. long, rather abruptly short-acuminate to merely acute, entire or nearly so, slightly decurrent; *costa rather thin and reaching the leaf middle, short and double or almost wanting, sometimes all these variations on the same plant*; median leaf cells oblong-fusiform $\pm 8 \times 30 \mu$, median basal 45-50 μ long, upper marginal and apical oval, oblong

or rhomboidal, 2-3 : 1, a large area of the basal-marginal cells very small and rounded-quadrate; branch leaves smaller, often serrulate at apex; perichaetial leaves slenderly acuminate, sheathing, as long as the seta or usually a little longer; capsule ovoid-cylindric to oblong-ovoid, urn about 1.5 mm. long; operculum rostrate, not quite $\frac{1}{2}$ the length of the capsule; peristome teeth lance-linear, very slender at the tips, sometimes perforate along the median line; inner peristome a membrane usually more or less torn and adhering to the teeth; calyptra cucullate, reaching well below the capsule middle, bearing a few long hairs; spores late autumn to winter. Type locality, eastern North America.

ILLUSTRATIONS:—Sull. *Icones Musc. pl. 71*; M. H. M. *pl. 86*.

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 233, (Ed. 2) 352*; Aust. *Musc. Appal. 254*; Grout, N. Am. *Musc. Pl. 123, 321*; Sull. *Musc. Allegh. 88*; Drumm. *Musc. Am. 78*, S. States 92.

On trees and rocks in cool woods, New England to Ontario and south to the Gulf States. Frequent and fruiting freely.

In xerophytic forms growing on rocks the leaves are sometimes broadly ovate with smaller cells, especially along the upper margin.

In view of the wide variations the following forms can scarcely be considered of more than varietal rank. The description in M. H. M. and indeed other available descriptions are more or less misleading and the fact that *Musc. Bor. Am. (Ed. 1) 235*, issued as *Leptodon ohioensis* is badly mixed with this species has increased the confusion.

Var. *IMMERSUS* (Sull.) Lesq. & James Manual, 278. 1884.

Leptodon immersus Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 234*. 1856.

Capsules immersed; perichaetial leaves reaching at least to the mouth of the urn, much less slenderly acuminate as a rule.

EXSICCATI:—Sull. & Lesq. l. c.; Austin, *Musc. Appal. Suppl. 527*; Grout, N. Am. *Musc. Pl. 226*. Frequent in Georgia and Florida and probably in all the Gulf States.

Var. *FLORIDANUS* (Lindb.) n. comb.

Leptodon floridanus Lindb. *Krit. Gransk. Moss. Dill. 53*. 1883.

Plants mostly smaller; seta longer than the perichaetial leaves.

Occasional in peninsular Florida.

A series could be arranged with the capsules entirely immersed in the first specimen and gradually emergent to the fully exerted form. Without the sporophytes I do not think one could distinguish the species from the varieties. The description of the leaves in the Lesq. & James Manual states that the leaves in *L. floridanus* are "broader and ovate." On the contrary I find the leaves of specimens with the fully exerted capsules narrower than the average. I also find the narrowly ovate-lanceolate and broadly ovate leaves in the northern forms.

Also the capsules in the var. *floridanus* are not smaller than is frequent in the species and porose basal cells are also frequent in the older leaves of the species.

The var. *irriguus* Renauld, Lesq. & James Manual, 278, 1884 is apparently only a form from a wet habitat, though type specimens have not been seen.

2. LEPTODON OHIOENSIS Sull. *Musc. Allegh. 89*. 1846.

Smaller, more slender and darker colored than the last, little branched; leaves closely appressed-imbricate when dry, not plicate, ovate to ovate-lanceolate, acute to short-acuminate, concave with margins slightly reflexed, ± 1.2 mm. long, slightly decurrent, entire or margins slightly uneven near apex; *costa strong, extending beyond the leaf middle and strongly protruding on the dorsal side of leaf*; leaf cells often slightly papillose dorsally, rounded-oval in the median portion of leaf, thick-walled, about 6μ wide, 1.5-2.5 : 1, slightly elongated at insertion; marginal cells rounded-quadrate below, short oval above. Capsule and peristome much as in the last, but the perichaetial leaves somewhat shorter than the seta. Type locality, Ohio (Sullivant).

ILLUSTRATIONS:—Sull. *Icones Musc. pl. 72*; *Pl. 68*.

EXSICCATI:—Sull. l. c.; Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 235, (Ed. 2) 354*.

On trees in deep woods, central Ohio. Apparently rare and reported from the vicinity of the type locality only. Sull. & Lesq. no. 235, in my set at least, is badly mixed with the last, also (Ed. 2) 354. This has apparently led to much confusion. Except that they are somewhat larger, the leaves of this species are surprisingly like those of *Cryphaea glomerata*.

LEPTODON NITIDUS Sull. Icones Musc. Suppl. 80. pl. 60. 1874.

Plants yellowish green, glossy; secondary stems erect or curved, 3-6 cm. long, irregularly branched, with branches short, slender and densely foliate; leaves erect-imbricate, broadly oblong-ovate, acute to short-acuminate, concave, ± 1.2 mm. long, decurrent and subauriculate at base, entire or subserrulate near apex; costa simple, vanishing before the leaf middle, or double or forking and much fainter, sometimes lacking; leaf cells smooth, the median elongated-rhomboidal to oblong-linear, $\pm 8 \mu$ wide, 3-6 : 1; apical short-rhomboidal,* 2 : 1; a few (2-8 marginal) short-rectangular at the subauriculate basal angles; perichaetial leaves broadly ovate or lingulate, acute, ecostate, the upper reaching beyond the mouth of the urn. Monoicous; capsule immersed on a very short seta, ovoid-globose, urn with a dark colored mouth; operculum broadly conical, apiculate; peristome simple, teeth linear-lanceolate, very brittle.

Type locality on elms in a swamp (now cleared) near Belleville, Ontario (Macoun). The only known locality.

ILLUSTRATIONS:—Sull. l. c.; Pl. 68.

CRYPHAEACEAE.

Main stems creeping, stoloniform; secondary stems erect or ascending, often with axillary paraphyllia, variously branched; leaves close, symmetrically arranged on all sides of the secondary stems and branches, imbricate when dry, more or less spreading when moist, concave, mostly not plicate, ovate to ovate-lanceolate, often papillose dorsally; costa single, usually well developed; leaf cells mostly thick-walled with an oval or narrowly elliptical lumen; at the basal margins many subquadrate rounded cells; median basal usually more elongated. Autoicous; seta usually very short and capsule often immersed; capsule erect and symmetric; peristome double, the teeth 16, well developed; segments narrowly linear to lanceolate from a very low basal membrane, rarely lacking; calyptra conical or bell-shaped, small, more or less roughened to hairy, in our species.

In many cases scarcely to be distinguished from the *Leucodontaceae* except for the double peristome. The leaves of *Leptodon ohioensis* are scarcely to be distinguished from some forms of *Cryphaea glomerata* and it is probable that that species should be put in a different genus and transferred to this family. Our species are mostly found on trees, rarely on rocks.

KEY.

- | | |
|--|-------------------------|
| 1. Capsule immersed; calyptra conical; paraphyllia lacking..... | 1. <i>Cryphaea</i> . |
| Capsule emergent or exserted; calyptra cucullate..... | 2. |
| 2. Paraphyllia lacking; seta much longer than perichaetial leaves..... | 2. <i>Antitrichia</i> . |
| Paraphyllia present; seta about the length of perichaetial leaves or a little longer.... | 3. |
| 3. Leaves smooth at back..... | 4. <i>Alsia</i> . |
| Leaves sharply papillose on the back above..... | 3. <i>Dendroalsia</i> . |

1. CRYPHAEA Mohr, in Web. Tab. Synop. Musc. 1813.

Leaves mostly broadly ovate, acute to short-acuminate, entire or slightly serrulate above; leaf cells small, rounded, very thick walled, isodiametric to 2 : 1, papillose at back; costa strong, reaching at least to the leaf middle, projecting at back; upper perichaetial leaves more or less obtuse, tipped by the strong excurrent, more or less roughened costa (except *C. Ravenelii*); the lower more gradually long acuminate with the costa excurrent; capsules mostly ovoid; peristome double, teeth usually papillose; segments narrowly linear; cilia lacking. Type species, *C. heteromalla* Mohr.

KEY.

- | | |
|--|-----------------------|
| 1. Leaves rounded-obtuse; peristome single..... | 3. <i>Ravenelii</i> . |
| Leaves acute to acuminate; peristome double..... | 2. |
| 2. Costa ending in or near leaf apex..... | 2. <i>nervosa</i> . |
| Costa ending near leaf middle..... | 1. <i>glomerata</i> . |

* Much shorter than figured by Sullivant. Type studied by courtesy of New York Botanical Garden.

1. CRYPHAEA GLOMERATA Schimp., Sull. in Musci & Hepat. U. S. 56. 1856 and Bry. Eur. Fasc. 44-45. 1850. (name only).

Cryphaea filiformis Sull. Musc. Allegh. 81. 1846 (not of Hedw.).

Cryphaea pendula Lesq. and James. Proc. Am. Acad. Sci. 14: 138. 1879.

Plants in thin loose mats, light green above, brownish below; secondary stems sparingly divided, little branched, slender, sometimes with slender branchlets having narrow slenderly acuminate leaves; leaves closely imbricated when dry, julaceous, ovate to ovate-elliptical, acute to short-acuminate, concave, ± 1 mm. long; margins slightly recurved below, entire or slightly serrulate at apex; costa strong, reaching at least the leaf middle, projecting on the dorsal side; leaf cells as described for the genus, only those in the median basal $\frac{1}{3}$ as long as figured, the median subcircular to oval, ± 7 wide, the lumen 4-5 μ wide; perichaetial leaves scarious, as long as the capsule or longer, the outer gradually long-acuminate by the strong excurrent costa, the inner broadly obtuse with the costa excurrent into a longer or shorter point, more or less roughened, leaf cells linear-rhomboidal in the lower half, without chlorophyll. Seta exceedingly short, scarcely apparent; calyptra conical, little longer than the operculum, smooth or rough, entire or split when old, deciduous with the operculum; capsule short-oblong to ovoid, urn ± 1 mm. long, operculum conic; annulus large; peristome teeth slender, papillose; segments much shorter, very narrowly linear and hard to demonstrate; spores in spring. Type locality, New Orleans.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 67; Pl. 67.

EXSICCATI:—Drumm. Musc. Am. S. States, 99 (as *Daltonia heteromalla* var.); Sull. Musc. Allegh. 81; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 230, (Ed. 2) 347; Aust. Musc. Appal. 253 and Suppl. 526 (as *C. pendula* Lesq. ined.); Grout, N. Am. Musc. Pl. 32, and Musci Perfecti 218 in part.

Austin's 526 is apparently one of the type forms of *C. pendula* and neither in this or the descriptions can I find any characters to separate *C. pendula*, except "perichaetial leaves with a short acumen, the solid costa vanishing at or below the apex." This is not true of Austin's plants and the variations of this species are greater than indicated in any previous literature.

On trees and shrubs, Gulf States, north to Connecticut; west to Texas; frequent and fruiting freely, but usually occurring in small quantities. Rare west of the Mississippi.

Var. SCABRA n. var.

Leaves less closely imbricate, 1.2-1.5 mm. long, subclasping, strongly excavate and almost auriculate at base; perichaetial leaves not scarious, the upper less obtusely narrowed to the long (0.5-0.7 mm. long) very rough excurrent costa which is rough some distance below leaf apex. Capsules often at the end of stem or branch and relatively inconspicuous. Type from branches of shrubs, Deep Lake, Florida Everglades, March 41, 1931, Grout & McFarlin no. X°. Pl. 63.

If it were not for the variations in the direction of the above noted characters in the considerable range of specimens studied, this would be considered a new species. Its field appearance is very different from the species. Grout, Musci Perfecti 218 in part; this is co-type and easily distinguished with a lens by the perichaetial leaves the same color as the others and with hair-like points.

2. CRYPHAEA NERVOSA (Hook. & Wils.) Bry. Eur. l. c.

Daltonia nervosa Hook. & Wils. in Drumm. Musc. Am. S. States 100. 1841.

Closely resembling the last, differing in the less crowded leaves, narrower, ovate-lanceolate to lanceolate, longer acuminate, ± 1 mm. long; median cells along the costa linear below, oblong above; costa ascending to near or into the apex; papillose-roughened at back; perichaetial leaves very rough above with large papillae, gradually slenderly acuminate, the inner finely serrulate above. Capsule shorter and relatively broader, with a ring of dark colored cells around the mouth; annulus of a single row of cells. Type locality near New Orleans.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 68; Pl. 67.

EXSICCATI:—Drumm. l. c.

Described from Drummond's 100 by courtesy of the New York Botanical Garden.

On trees and shrubs, rare; Gulf States; S. Carolina.

3. CRYPHAEA RAVENELII Aust. Bot. Gaz. 2: 89. 1877.

Forsstroemia Ravenelii Kindb. Bryin. Eur. & N. Am. 7. 1897.

Plants dirty green; secondary stems short, 2-3 cm. long, julaceous, nearly simple; leaves imbricate-appressed when dry, oblong-ovate to ovate, rounded-obtuse at apex, ± 1.2 mm. long, very concave, spoon-

shaped, with entire margins slightly reflexed below; costa stout, extending $\frac{3}{4}$ the length of the leaf; *leaf cells very dense and thick-walled*, papillose at back, $\pm 6 \mu$ wide, *nearly uniform throughout except at median leaf base*, circular to short-oval, transversely elongated at basal angles; median basal linear to oblong, often colored at insertion; perichaetial leaves thin and pale, the inner abruptly short-acuminate by the excurrent costa which may be thin and vanishing in places or extending through the whole leaf. Capsule immersed, urn about 1.2 mm. long, with a *bright red border around the mouth*, ovoid to oblong-ovoid; operculum conic; *peristome single, apparently of 8 perforate teeth but in reality of 16 slender teeth more or less united in pairs*, about 0.7 mm. long, with very few articulations, irregularly roughened and lighter colored than the mouth of the capsule.

Described from the type collection at Rome, Georgia, by Ravenel, 1874, courtesy of the New York Botanical Garden. *Pl. 63.*

A beautiful and distinct species, noteworthy for its single peristome. Apparently very rare. No other collections found.

2. ANTITRICHIA Brid. Musc. Recent. Suppl. 4: 136. 1819.

Secondary stems usually long, procumbent or pendent, simple or divided, densely foliate, irregularly to subpinnately branched; paraphyllia lacking; central stand rudimentary or lacking; leaves appressed-imbricate when dry, occasionally somewhat secund, cordate-ovate to ovate-lanceolate, rather abruptly acuminate, lower margins revolute; costa strong, ending below the apex, sometimes with one or two short, supplementary costae at base; leaf cells thick-walled and porose, in the basal angles rounded-quadrate to elliptical cells reach nearly to the costa and well up the margin; median cells with a linear lumen. Dioicous; capsule exserted on a seta 5–12 mm. long; oblong-ovoid to cylindric, erect and symmetric; calyptra smooth, naked, cucullate; annulus present; peristome double, without cilia, and segments poorly developed. Type species, *A. curtispindula*.

KEY.

Leaves with supplementary costae; capsule 2–2.5 : 1.....1. *curtispindula*.
Leaves without supplementary costae; capsule 3–5 : 1.....2. *californica*.

1. ANTITRICHIA CURTISPINDULA (Hedw.) Brid. l. c.

Neckera curtispindula Hedw. Sp. Musc. 209. 1801.

Plants large, in large loosely tangled mats, yellowish green in the tips, brown below; secondary stems 10–20 cm. long, densely foliate; leaves loosely imbricated, often subsecund, decurrent, ovate to broadly ovate-lanceolate, rather gradually long-acuminate, 2–3 mm. long, concave and usually somewhat plicate when dry; *margins strongly revolute below, sharply dentate-serrate above with long, often reflexed teeth especially at apex*; costa strong, often divided at base, vanishing below apex; median leaf cells oblong-linear, about 6μ wide, 3–5 : 1, basal angular cells as described above; perichaetial leaves sheathing, the inner abruptly filiform-acuminate, nearly ecostate. Seta 5–15 mm. long, more or less flexuous; capsule symmetric, oblong-ovoid, ± 3 mm. long; operculum conic-rostrate, $\frac{1}{8}$ – $\frac{1}{2}$ the length of the urn; inner peristome without basal membrane, segments nearly as long as teeth, filiform, fragile; spores in spring. Type locality Giessen (Dillenius).

ILLUSTRATIONS:—Bry. Eur. *pl. 469*; Dixon & Jameson, Handb. British Mosses (Ed. 3) *pl. 50A*; *Pl. 70*.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 236, (Ed. 2) 355; R. & C. Musc. Am. Sept. 315.

On shaded trees and rocks; mountains of North Carolina, Lake Superior region and the West Coast of N. America from Alaska to California. The West Coast plants are mainly the variety.

Even in Europe the species varies widely, some forms stout with stems and the few branches stout, julaceous and blunt; others more slender and freely branched, with branches slender and tapering and the leaves somewhat secund.

Var. GIGANTEA Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 356.

Plants larger; branching sometimes regularly but distantly pinnate, much as in *Rhytidiadelphus triquetrus*, branches sometimes very slender at end; leaves often loosely imbricate and strongly secund; leaves of secondary stems often slightly serrate or nearly entire at apex; costa with 3–5 branches; branch leaves dentate-serrate as in the species; capsule longer and narrower as a rule. Any of these characters is variable, some may be like the species while the others are those of the variety.

EXSICCATI:—Grout, N. Am. Musc. Pl. 67, 228.

2. **ANTITRICHIA CALIFORNICA* Sull. Trans. Am. Phil. Soc. 13: 11. 1863.* *Antitrichia tenella* Kindb. Bull. Torr. Bot. Club, 17: 275. 1890.*Antitrichia curtispindula* Sull. Pacif. R. Rep. 4: 189. 1856.

Secondary stems shorter, 5-10 cm. long, appearing more slender than the last by reason of the nearly or quite julaceous slender branches and the non-second leaves;† branching often almost regularly pinnate with short, subequal branches, 5-15 mm. long; stem leaves as a rule much less strongly toothed above, but branch leaves as in the last; costa very wide and stout at base but seldom branched, usually reaching farther up into the apex; median leaf cells shorter, about 15 μ long with very thick walls and a linear-flexuose lumen in old leaves, in younger leaves with a thinner wall and an oval lumen as shown in Sullivant's plate. Capsules cylindric to oblong-cylindric, urn reaching 3.5 mm. long and narrower; annulus apparently lacking; peristome teeth strongly papillose throughout, segments very short and fragile as figured, sometimes partially adherent to the teeth; spores rough, 15-20 μ , ripening in early spring. Type from California.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. pl. 59; Pl. 64.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 357; Grout, N. Am. Musc. Pl. 166; Allen, Mosses Cascade Mts. 87; Baker, Pacific Coast Bryophytes 293.

On rocks soil and trees; Los Angeles Co., California, to British Columbia, east to Colorado.

The capsules of this species are narrower rather than very much longer than those of the preceding. The stem leaves of var. *gigantea* are often as slightly serrulate as those of *A. californica* but in sterile specimens the habit and short leaf cells of *A. californica* are in most cases sufficient for identification. But in some cases the leaf cells approach those of *A. curtispindula* and depauperate or undeveloped plants are often difficult to place.

3. DENDROALSIA E. G. B. Bull. Torr. Bot. Club, 32: 263. May, 1905.

Groutia Broth. Engler & Prantl, Musci (Ed. 1) 760. Aug. 1905.

A monotypic genus. The differences between *Leptodon circinnatus* Sull. and *Neckera abietina* Hook. as set forth by Mrs. Britton, Bull. Torr. Bot. Club 32: 264 and 265 are not correlated. The differences occur in *Dendroalsia* but seem to be wholly unrelated. Tall plants 5 inches high, with slender naked stipes 2-3 inches long are sometimes males, with leaves not papillose to base, while short plants about 2 inches high with very short stipes fruit freely and have leaves often papillose to base. In general the undeveloped upper leaves are relatively broader and more papillose near base. The plants are not rare, as there are plants of 15 different collections in my private herbarium. The differences seem to be due to habitat conditions, as Sullivant surmised.

DENDROALSIA ABIETINA (Hook.) E. G. B. l. c.

Neckera abietina Hook. Musc. Exot. pl. 7. 1818.*Alsia abietina* Sull. Icones Musc. 115. pl. 72b. 1864.*Leptodon circinnatus* Sull. Pac. R. Rep. 4: 189. pl. 1. 1856 (sometimes *circinalis* by error).*Alsia Macounii* Kindb. Bull. Torr. Bot. Club 17: 275. 1890.

Secondary stems frondiform, pinnately to bipinnately branched above, with a longer or shorter unbranched stiff and elastic stipe-like portion below, reaching 25 cm. in length,‡ but usually 10 cm. or less, more or less circinate when dry; branched paraphyllia numerous; branches 1-2 cm. long, sometimes ending in slender flagellate tips, leaves of stipe broadly lanceolate to ovate-lanceolate, 2.5-3.5 mm. long, somewhat plicate, especially when dry, colored at the base, gradually acuminate, with acumen short and broad to long and slender; median cells oblong linear, thick-walled, 7 μ wide, 3-5 : 1, longer and porose at base; costa very strong and deeply colored, ending a short distance below the apex; leaves of the upper stem smaller and narrower, 2-2.5 mm. long, gradually narrowed to an obtuse serrulate apex; leaf cells less incrassate; all stem leaves with margins revolute below, more or less concave, papillose at back with large sharp papillae, which are often few or lacking in the leaves of the stipe; angular and lower marginal cells nearly isodiametric, rounded-quadrate to irregular in outline, 10-12 μ wide; leaves of branches and branchlets smaller, more strongly papillose and often acute; inner perichaetial leaves usually a very little longer than the seta, abruptly short-acuminate, with the costa slender below and either excurrent into the

* "Seems to be the young shoots before they branch." Mrs. Britton in notes at N. Y. Bot. Garden.

† Slightly second in var. *ambigua* R. & C. Bot. Gaz. 15: 59. 1890.

‡ Mrs. Britton l. c.

short acumen or ending below the apex. Dioicous; antheridial buds very numerous along the stem and branches; archegonia borne along the stem; seta 0.6–0.8 mm. long; capsule oblong-ovoid to ovoid, urn about 2.5 mm. long, strongly plicate when dry; operculum conic-rostrate; annulus present; peristome teeth almost linear, 0.6 mm. or more in length, strongly papillose; segments somewhat shorter, from a narrow basal membrane, narrow, somewhat carinate and often open between the articulations, strongly papillose; calyptra cucullate, naked, longer than the operculum; spores in spring, very rough, 18–25 μ in diameter. Type locality, northwest coast of North America (Menzies 1792). Type in the herbarium of Hooker.

ILLUSTRATIONS:—Sull. l. c.; Hook. l. c.; *Pl.* 69.

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 2) 400; Grout, *N. Am. Musc. Pl.* 379; Allen, *Mosses Cascade Mts.* 83; Baker, *Pac. Coast Bryophytes* 118.

On trees and ledges; California to British Columbia, east to Idaho. Dr. Bailey has sent me specimens from California used to pack vegetables sent to Washington.

4. ALSIA Sull. *Proc. Am. Acad.* 3: 185. 1855.

Plants in thick loose mats; secondary stems erect or ascending, densely foliate, with branching more or less regularly pinnate above and frondiform; branched paraphyllia present; costa various even on the same plant; leaf cells much like those of *Leptodon*; upper median short, oval-oblong, about 3 : 1; a large area of marginal cells, especially at the basal angles, small, rounded, not longer than broad, some broader than long. Dioicous; capsules short, nearly or quite erect and symmetric, on a short seta, which is usually shorter than the perichaetial leaves; stomata present; annulus not differentiated; peristome double, segments from a narrow basal membrane, cilia lacking; operculum conic-rostrate; calyptra cucullate, naked. Type species *A. californica*.

ALSIA CALIFORNICA (Hook. & Arn.) Sull. l. c.

Neckera californica Hook. & Arn. *Bot. Beechey's Voy.* 162. 1841. (1833 according to Mrs. Britton, *Bull. Torr. Bot. Club.* 32: 263. 1905.)

Antitrichia pseudo-californica Kindb. *Eur. & N. Am. Bryin.* 9. 1897.

Secondary stems 2.5–5 cm. high, with branching more or less regularly pinnate, branches short, of unequal length, 3–6 mm. long; stem leaves loosely imbricate when dry, scarcely plicate; ovate to broadly oblong-lanceolate, gradually acute to acuminate, varying in length from 1.2 to nearly 2 mm. in length, entire to slightly serrulate at apex, smooth, concave, with margins more or less reflexed below; costa almost lacking, short and double, or stout, reaching nearly to leaf middle (all forms occurring on the same plant); median cells near leaf base \pm 10 μ wide \times 30–60 μ , oblong-linear, somewhat porose, thick-walled, those at insertion shorter and often colored; the median cells of the upper $\frac{1}{3}$ oval-rhombic, \pm 10 μ wide, 2–3 : 1; marginal cells in the lower $\frac{2}{3}$ rounded-quadrate, gradually changing in shape towards the leaf middle, all marginal and apical cells shorter than the median; branch leaves smaller, usually relatively narrower and often ecostate; slender flagella with small ecostate leaves often present (var. *flagellifera* R. & C.); inner perichaetial leaves \pm the length of the seta, lanceolate, costate, long and slenderly acuminate. Capsules oblong-cylindric, urn reaching 2 mm. in length, often slightly unsymmetric; segments of inner peristome much shorter than the teeth, unusually persistent; spores apparently in spring. Type locality, west coast of North America.

ILLUSTRATIONS:—Sull. *Musc. Wilkes Exped.* *pl.* 25; Engler and Prantl (Ed. 2) 2: f. 495; *Pl.* 57.

EXSICCATI:—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 268b, (Ed. 2) 398; Grout, *N. Am. Musc. Pl.* 256 (this is var. *flagellifera* R. & C. *Bot. Gaz.* 14: 97. 1889).

On tree trunks; California to Puget Sound.

This genus is very close to *Leptodon*, separated mainly by the double peristome with basal membrane and segments.

FABRONIACEAE.

As a whole the smallest and most delicate of the *Pleurocarpi*; mostly plants of warm regions, growing in thin velvety mats or tufts, often glossy, usually on trees, rarely on stones. Primary stems creeping, without central strand, composed largely of large thin-walled cells, producing many erect and simple or divided branches, which are densely foliate; paraphyllia lacking; leaves soft, thin, not papillose,* imbricate when dry, erect spreading when moist, slightly concave, never plicate, rarely decurrent or secund, mostly ovate to lanceolate, acuminate, entire to ciliate-dentate; costa extending $\frac{1}{2}$ length of leaf or lacking; leaf cells thin-

* Except *Schwetsckheopsis*.

walled, oblong-rhombic to narrowly oblong-hexagonal; alar often quadrate to short-rectangular. Capsules long-exserted, erect and symmetric, usually short, ovoid to nearly cylindric, often strongly contracted under the mouth when dry and empty; peristome single or double (rarely lacking), teeth 16, often united in pairs and reflexed as in *Orthotrichum*; segments, when present, narrowly linear, fragile; operculum short-conic to short-rostrate; calyptra cucullate, smooth and naked.

KEY.

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|---|------------------------------|
| 1. Leaves plainly costate..... | 2. |
| Leaves ecostate or nearly so | 4. |
| 2. Leaves slightly denticulate to long ciliate-dentate..... | 1. <i>Fabronia</i> . |
| Leaves entire (rarely minutely serrate at apex)..... | 3. |
| 3. Peristome double, teeth well developed, united in pairs and reflexed when dry... | 2. <i>Anacamptodon</i> . |
| Peristome single, teeth slender and irregular, not reflexed or united in pairs..... | 3. <i>Clasmatodon</i> . |
| 4. Leaves serrulate throughout; leaf cells slightly papillose at back..... | 6. <i>Schwetschkeopsis</i> . |
| Leaves entire or slightly serrulate at apex..... | 5. |
| 5. Peristome single..... | 4. <i>Habrodon</i> . |
| Peristome double; plants of western Canada..... | 5. <i>Myrinia</i> . |

1. FABRONIA Raddi, Atti dell. Acad. di Scienze di Siena 9: 230. 1808.

Plants exceedingly small and slender, in soft thin mats or patches; stems creeping, often stoloniferous, irregularly branched; branches often partly stoloniferous, the normal leafy parts julaceous; leaves often rather closely imbricate when dry, erect-spreading when moist, rarely somewhat secund, somewhat concave, not plicate, ovate to lanceolate, mostly slenderly subulate-acuminate or piliferous, nearly entire to serrate or even ciliate-laciniate, with plane margins; median cells elongate-rhomboidal to elongate-hexagonal; at basal angles or often across the entire leaf base many rows of quadrate cells (occasionally greatly reduced in number); costa delicate and short, sometimes scarcely visible; seta 3-7 mm. long, slender, smooth; capsules erect and symmetric, ovoid to pyriform, with a short neck, often plicate when dry, often cup-shaped to hemispheric; exothecial walls sinuous and often bulging; operculum apiculate or usually more or less rostrate; annulus lacking; peristome single, rarely lacking, very hygroscopic, at first united in pairs, broad, obtuse (much like those of *Orthotrichum*), infolded when wet, spreading to reflexed when dry; calyptra cucullate, small deciduous.

KEY.

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|--|-----------------------------|
| 1. Leaves laciniate-dentate, with teeth often of more than one cell..... | 2. |
| Leaves from nearly entire to dentate with large projecting marginal cells..... | 3. |
| 2. Peristome present; frequent in the West..... | 2. <i>pusilla</i> . |
| Peristome lacking; very rare..... | 3. <i>gymnostoma</i> . |
| 3. Leaves entire or nearly so..... | 5. <i>Ravenelii</i> . |
| Leaves from dentate to ciliate-dentate with single cells..... | 4. |
| 4. Leaves ovate to broadly ovate-lanceolate..... | 5. |
| Leaves for the most part broadly ovate..... | 7. |
| 5. Leaves lanceolate, moderately and rather evenly serrate..... | 4. <i>Wrightii</i> . |
| Leaves broader, ovate-lanceolate..... | 4. var. <i>intermedia</i> . |
| Leaves ovate-lanceolate, strongly and irregularly serrate-dentate by projecting cells..... | 6. |
| 6. Median leaf cells about 9 μ wide, 3-5 : 1 in American plants (4-9 : 1 in European) | 1. <i>ciliaris</i> . |
| Median leaf cells 13 μ wide, 2.5-4 : 1..... | 1. var. <i>Bartramii</i> . |
| 7. Leaves slightly serrate; peristome imperfect..... | 6. <i>imperfecta</i> . |
| Leaves strongly serrate-dentate; peristome normal for the genus..... | 1. var. <i>ovata</i> . |

1. FABRONIA CILIARIS (Brid.) Brid. Bryol. Univ. 2: 171. 1827.

Hypnum ciliare Brid. Musc. Recent. Suppl. 2: 155. 1812.

Fabronia octoblepharis (Schleich.) Schwaegr. Suppl. 1²: 338. pl. 99. figs. a & b. 1816.

Pterogonium octoblepharis Schleich. Catal. (Ed. 2) 30. 1807 (name only).

Fabronia pusilla Schwaegr. l. c. 337 (not of Raddi, 1808).

Plants small, in thinly cespitose mats or patches; branch leaves symmetrically erect-spreading when moist (rarely two-ranked or secund at ends of branches), ovate-lanceolate, coarsely and irregularly serrate-dentate by single marginal cells of *varying length*, very slenderly long-acuminate, the tip of the acumination consisting of a single linear cell reaching 40–60 μ in length, reaching 1 mm. in length in European specimens, but rarely over 0.6 mm. in American forms; costa $\pm \frac{1}{2}$ the length of leaf, rather thin and vanishing in elongated cells; leaf cells in American plants linear-rhombic to oblong-hexagonal, 8–10 μ wide, 3–5 : 1; a large area of basal cells quadrate to short-hexagonal. Monoicous; seta 4–7 mm. long; capsule ovoid to urn-shaped when empty, with a thick neck, about 1 mm. long, operculum mammillate; peristome as described for the genus; spores in spring, rough, 15–18 μ in diameter. Type locality European.

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. *pl.* 451; M. H. M. f. 211.

EXSICCATI:—Aust. Musc. Appal. Suppl. 535; Grout, N. Am. Musc. Pl. 451; R. & C. Musc. Am. Sept. 189. On rocks and bark of trees, New Jersey to Minnesota, south to Arizona, New Mexico and the South Atlantic States.

Var. *OVATA* n. comb.

Fabronia octoblepharis var. *ovata* Grout, Bryol. 29: 5. 1926.

Most leaves crowded, broadly ovate to almost circular and more abruptly acuminate, widely spreading when moist; median cells 10–12 μ wide, 2–3 : 1, quadrate alar cells sometimes extending nearly half way up the margin. Type from willows near Lewiston, Minn., July 5, 1919 (Holzinger). Mixed with occasional subtypical forms. Type in herb. A. J. G.

Var. *BARTRAMII* n. comb.

Fabronia Bartramii Grout, Bryol. 29: 4. 1926.

Leaves shorter than *F. Wrightii* or its var. *intermedia*, 0.4–0.6 mm. long, ovate to ovate-lanceolate and rather abruptly acuminate or broadly ovate-lanceolate and less abruptly acuminate, nearly entire to as serrate as figured for *Wrightii*; median leaf cells, 15 μ wide, 3–4 : 1; costa thin and faint rarely reaching the leaf middle; seta 1.5–2.5 mm. long; capsule turbinate when dry and empty, cup-shaped to almost hemispheric when moist; urn with neck about 0.6 mm. long, nearly as wide when mounted on a slide; operculum mammillate; spores 17–20 μ in diameter, ripening in winter. Type from face of overhanging banks along Harshaw Creek near Patagonia Mts., Santa Cruz Co., Arizona, alt. 4500 ft. (Bartram no. 631, Feb. 14, 1923). Type in herb. A. J. G., also cotypes issued as no. 493, Grout, N. Am. Musci Pl.

On banks and in rock crevices; collected by Bartram in several localities in Arizona, nos. 583a, 633, 640, 720, 894, & 972. A single collection was made on trees.

This species varies so much, both in North America and Europe, that this, together with its minute size, make it very difficult to draw satisfactory descriptions. Cardot's Musc. Eur. 240 has leaves reaching 1 mm. in length and median leaf cells slightly removed from the end of the costa reaching 75 x 9 μ , while plants from Thériot have shorter leaves with corresponding cells 60 x 12 μ .

The Bry. Eur. figure reproduced in M. H. M., l. c., has median cells 5 : 1. Schwaegrichen's figure cited above has the short acumination of var. *Bartramii* and its short broad leaf cells. No two American specimens seem to match and there is great variation in the same tuft. North Am. Musci Pleurocarpi 451 is as close to some European plants as any other American plants I have seen.

Var. *ovata* is probably a sport due to local conditions. Hedwig in the same plate cited illustrated a form with teeth as long in the leaf serrations as in *F. pusilla* and both in Europe and America *ciliaris* and *pusilla* seem to intergrade. *Gymnostoma* seems to have been collected but once and its leaves cannot be distinguished from those of *pusilla*. This leads one to suspect that it is an undeveloped form of *pusilla*.

Cardot's var. *americana* from Mexico (Rev. Bryol. 37: 50. 1910) is compared with the species (*octoblepharis* = *ciliaris*), smaller, more densely cespitose; leaves smaller, narrower, more gradually longer acuminate, with cells smaller. He states that most American specimens belong to this variety, but the acumination he describes is just opposite the tendency the author has noted in American plants. *F. ciliaris* seems to intergrade with *Wrightii* and the latter is best regarded as a subspecies.

*2. *FABRONIA PUSILLA* Raddi, Crit. Nov. et Rar. Plant. 2. *pl.* 1 in Atti dell' Acad. di Scienze di Siena 9: 230. 1808.

Apparently a subspecies of *F. ciliaris* from which it differs in the ciliate-laciniate margins of the leaves which usually have a longer hair point, a shorter fainter costa and broader and shorter leaf cells (Limpricht says 12 μ wide and 3 : 1); capsule usually shorter, urn with neck about 6 μ long; spores winter to early spring, rough, 12–17 μ in diameter. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 450; Raddi, l. c.
 EXSICCATI:—Baker, Pacific Coast Bryophytes, 289; Grout, N. Am. Musc. Pl. 402 & 436; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 375.
 On trees, rarely on rocks. British Columbia, Idaho, California, Arizona, New Mexico and Colorado.
 Only a very small proportion of the marginal teeth of the leaves is multicellular; most are unicellular like the large teeth in *F. ciliaris*.

*3. *FABRONIA GYMNSTOMA* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 254, 1856. (Ed. 2) 378.

Much like the preceding and difficult to distinguish if sterile. The leaves average a little shorter and the margins less lacinate. The costa is stronger and reaches the middle of the leaf or beyond. There is no peristome, the mouth of the pyriform capsule being closed by a transverse membrane. Type from near Santa Fe, New Mexico (Wright). No other collection has been reported except (Ed. 2) 378. No. 254 has been carefully studied but the above are the only differences noted.

ILLUSTRATIONS:—Sull. Icones. Musc. *pl.* 86; *Pl.* 72.

*4. *FABRONIA WRIGHTII* Sull. Mosses U. S. 61. 1856, & Icones Musc. 133. *pl.* 84.

Close to *F. ciliaris* but differs in the lanceolate, less strongly serrate-dentate leaves, ± 1 mm. long, having the margins rather evenly and regularly serrate by projecting cells, which are often much longer proportionally than figured; median leaf cells $\pm 12 \mu$ wide, 2-4 : 1, oblong-hexagonal; quadrate alar cells much less numerous. Seta 2-4 mm. long; capsule pyriform; operculum conic-apiculate; spores 11μ in diameter. Type locality, Texas (Wright).

Specimens of what is the type collection, Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 251, have been studied. Some of the leaves are almost as strongly toothed as those of *F. ciliaris*.

ILLUSTRATIONS:—Sull. l. c.; *Pl.* 72.

EXSICCATI:—Sull. & Lesq. l. c. and (Ed. 2) 374.

Also in Arizona (Bartram).

Var. *INTERMEDIA* Grout, Bryol. 29: 4. 1926.

Leaves ovate-lanceolate, sometimes broadly so; margins serrate as figured for the species; leaf cells averaging shorter. Type Bartram's 593, issued as N. Am. Musc. Pl. 494. On bark of oak, Red Mt., Patagonia Mts., Santa Cruz Co., Arizona. Type in herb. A. J. G.

Bartram has made several collections in Arizona, some on rocks, some on trees. (See original description for details.)

When the original description was drawn the author did not have access to Sull. & Lesq. Musc. Bor. Am. 251, hence a little discrepancy. The marginal serration in Sullivant's plate is quite misleading.

5. *FABRONIA RAVENELII* Sull. Mosses of the U. S. 61. *pl.* 14. 1856.

Fabronia caroliniana Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 253. 1856.

Closely resembles *F. Wrightii*. Leaves broader, often nearly or quite entire, ± 0.6 mm. long; quadrate alar cells more numerous as figured; spores $\pm 17 \mu$ in diameter, maturing in spring.

Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 252 is the type collection; collected in South Carolina by Ravenel. On bark of trees and decaying logs; Pennsylvania to Tennessee and Georgia, probably in all the Gulf States; rare.

ILLUSTRATIONS:—Sull. Icones Musc. *pl.* 85; *Pl.* 72.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 376 and 377 as var.

The *Fabroniceae* are the pygmies of the pleurocarpous mosses. Their small size and the great variation in the leaves on a single plant make satisfactory descriptions difficult. The data in the above descriptions of leaves and leaf structure have been drawn from the best developed leaves obtainable. The sinuous exothelial cell walls, the *orthotrichoid* but simple peristome and the hair-pointed leaves enable one to recognize the genus easily, but the species intergrade in many particulars in a most puzzling way, especially as there is so great a variation in the leaves of a single plant. *F. pusilla* might be regarded as one extreme of a series ending at the other extreme in *F. Ravenelii*.

6. *FABRONIA IMPERFECTA* Sharp, Bryol. 36: 20. 1933.

(Description quoted.)

"Plants delicate, green (sometimes graying upon drying); found growing in densely interwoven mats resembling velvet. Stems creeping; branches many, erect, short and julaceous. Leaves imbricate-spreading

(ovate to) obovate, concave, costate to about the middle; apices piliferous; margins serrate to dentate with projecting cells (or nearly entire). Cells of the basal angles quadrate; in the upper part of the leaf, short elliptical; in the hair, long and slender. Perichaetial leaves somewhat more lanceolate, ecostate. The sporophyte differs from the other North American species only in the matter of peristome. Teeth none or one to five, irregularly placed, small, hyaline or very pale yellow, often imperfect and truncate. Oral membrane none. Spores green, 10–15 μ in diameter." *Pl.* 71.

When sterile scarcely to be distinguished from forms of *F. Bartramii*; leaves about 0.5 mm. long, median leaf cells oblong-hexagonal, about 12 μ wide, 2.5–3 : 1. Capsule pyriform; operculum conic-apiculate; peristome of 1–5 teeth, irregularly placed. The exothelial cells are less sinuose than in *Bartramii* and there are 3–5 rows of narrow cells at mouth of urn, spores in early winter. N. Am. Musci Pl. Suppl. 42. *Pl.* 71.

"Type: On the bark of an American Elm (*Ulmus americana*) on the F. F. Van Deventer estate, 862 Temple Ave., Knoxville, Tennessee, alt. 950 ft., Dec. 27, 1932. The type material is deposited in the herbarium of The University of Tennessee."

Plants of this species with immature sporophytes were found earlier on a slate cliff at Kinzel Springs, Blount Co., Tennessee, alt. 1200 ft. Oct. 23, 1932. This material also is to be found in The University of Tennessee herbarium.

In gross appearance this species does not differ materially from the other North American species of *Fabronia*.

FABRONIA DONNELLII Aust. Bot. Gaz. 2: 111. 1877.

What is almost certainly cotype, if not the type, was found in the John Donnell Smith herbarium in the U. S. National Museum. The specimen was exceedingly small and had but one (imperfect) capsule.

It was found "Growing with *Macromitrium*, *Didymodon* and *Rhynchostegium microcarpum* in crotch of recently felled white oak." "At a hammock 8 miles west of St. Augustine, Fla." John Donnell Smith. . . . the specimen was marked "All of it." J. D. S. This specimen was studied through the courtesy of Dr. W. R. Maxon of The National Museum. The amount is too small to make a satisfactory determination or comparison. Description follows.

Plants very small, with the appearance of slender *Sematophyllum adnatum* with unusually narrow leaves; leaves lanceolate to linear-lanceolate, a little less than 1 mm. long, gradually narrowed to a slender acumination, slightly concave; margins entire, plane or slightly reflexed near the base; costa lacking; median leaf cells oblong-linear, \pm 8 μ wide, 6–8 : 1; at basal angles a patch of quadrate cells (6–8 on the margin), those at the insertion slightly inflated, hyaline or somewhat colored; perichaetial leaves nearly entire.

Seta about 4 mm. long; capsule oblong-ovoid, slightly inclined and unsymmetric; urn about 1 mm. long; no inner peristome seen but the single capsule was very old; teeth almost hyaline, strongly ridged at the back at the articulations (but not unusually so); exothelial cells rectangular, not collenchymatous or sinuous; a detached fragment of what resembled a portion of a segment of the inner peristome with a bit of basal membrane was observed.

If the leaves were at all serrulate I should refer it to *Brotherella*, near *B. tenuirostris* (Schimp.). It is not a *Fabronia*.

2. ANACAMPTODON Brid. Musc. Recent. Suppl. 4: 136. 1819.

We have one species characterized by entire leaves, costate to beyond the leaf middle. Peristome double with teeth united in pairs and recurved when dry; segments filiform, shorter than the teeth, basal membrane lacking.

ANACAMPTODON SPLACHNOIDES (Froehl.) Brid. l. c. *pl.* 2, f. 11.

Orthotrichum splachnoides Froehl. in Brid. Sp. Musc. 2: 4. 1812.

Plants in rather dense, thin, dark green, velvety mats; leaves ovate-lanceolate, rather gradually acuminate, reaching 1.5 mm. long, usually shorter, soft, somewhat concave, not decurrent, not plicate; margins plane and entire; costa extending to the middle or beyond; median leaf cells rhombic-hexagonal, about 12 μ wide, 3–5 : 1, a few at base quadrate to rectangular. Monoicous; seta 5–8 mm. long, light brown to chestnut; capsules brown to chestnut, erect and symmetric; urn about 1½–2 mm. long, oblong-ovoid, strongly constricted below the mouth when dry and empty; annulus none; operculum short-rostrate; peristome as described above; spores in June. Type locality, Ellwangen in Württemberg.

ILLUSTRATIONS:—Bry. Eur. *pl.* 453; Limpricht, Laubm. 2: 733. f. 338; M. H. M. 386, f. 210; Jennings, Mosses Western Pa. *pl.* 33.

EXSICCATI:—Sull. Lesq. Musc. Bor. Am. (Ed. 1) 255, (Ed. 2) 379; Sull. Musc. Allegh. 82; Drumm. Musc. Am. 94 (as *Neckera*); Grout, N. Am. Musc. Pl. 148 & 401, Musci Perfecti 176.

In moist cavities in decaying wood, especially knotholes. Widely spread but local; Maine to Illinois, south to the Gulf States. Not yet reported from Florida.

Var. TAYLORIAE Grout, Bryol. 9: 44. 1906. (*Tyloriae* by error.)

Leaves almost evenly narrowed from base to apex, costa almost percurrent; capsules slightly larger and operculum scarcely more than conic.

The young leaves in the species are often ovate and acute rather than acuminate. While this moss usually occurs in small patches, I have found patches about a foot in diameter on rock maple shade trees in the village of Newfane, Vt. One patch was below a large split in a fork of the tree, where moisture collected and trickled down.

3. CLASMATODON Hook. & Wils. Journ. Bot. 4: 421. 1842.

A monotypic genus with leaf structure much like that of *Anacamptodon*, but with leaves and leaf cells smaller, much more numerous quadrate angular cells, and a single peristome of 16 irregular filiform teeth. The plants are usually found on the bark of trees and shrubs in the Southern States.

CLASMATODON PARVULUS (Hampe) Sull. Mosses U. S. 60. pl. 5. 1856.

Leskea parvula Hampe, Linnaea 13: 46. 1830.

Fabronia Wrightii brachyphylla Kindb. Rev. Bryol. 22: 92. 1895.

Plants in thin loosely interwoven mats, bright green in the younger parts, brownish below; stems creeping, slender, irregularly divided; branches short, filiform, 2-5 mm. long, erect, mostly simple, mostly julaceous with closely imbricate leaves, which, however are occasionally somewhat secund; leaves from creeping stems broadly lanceolate, long and slenderly acuminate; leaves from the middle of branches ovate, acute to acuminate, 0.5-0.7 mm. long, concave, not decurrent, with margins plane and entire or nearly so, recurved toward the base; costa reaching about to the leaf middle; median leaf cells oblong-rhombic, 8-10 μ wide, 2-3 : 1; a large triangular area of quadrate alar cells reaching nearly to the costa (much more numerous than shown in Sullivant's figure); perichaetial leaves sheathing, ecostate, the inner lanceolate. Monoicous; seta very slender, 3-4 mm. long; capsule erect and symmetric, ovoid to oblong-ovoid; urn (including neck) 0.75-1 mm. long; operculum rostrate; calyptra cucullate; annulus of 2-4 rows of small cells, adherent; peristome as described, the teeth sometimes not entirely separated; spores in winter to early spring, finely papillose. Type locality, Savannah, Georgia.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 79; Limpricht, Laubm. 2: 741. f. 340; Bry. Eur. pl. 453 (as *Anisodon perpusillus*); Pl. 69.

EXSICCATI:—Drumm. Musc. Am. S. States 93 (as *C. pusillus* Hook. & Wils. 1841); Sull. Musc. Allegh. 80; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 246, (Ed. 2) 368; Aust. Musc. Appal. Suppl. 534; R. & C. Musc. Am. Sept. 82; Grout, N. Am. Musc. Pl. 231, Musci Perfecti 204.

On bark of trees and shrubs, rarely on rocks; common in the Gulf States, north to Oklahoma and Virginia.

Var. RUPESTRIS Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 246 b (name only); Lesq. & James Man. 298. 1884.

More densely tufted, stouter, leaves broadly ovate, obtuse to obtusely acute. Stem leaves in the type slenderly acuminate.

On rocks and trees. Type from Tennessee. Also in Pennsylvania.

From Texas Prof. F. McAllister sends a very robust form, the young branches a light yellowish green, with the leaves loosely imbricate, erect-open, very broad and 0.6-0.7 mm. long; stem leaves acute to short-acuminate. This is so distinct as to indicate a new species except for intergrading forms.

4. HABRODON Schimp. Syn. (Ed. 1) 505. 1860.

A genus of two species, of which one occurs in Europe and has been reported from North America, the other in Japan. Exceedingly slender, resembling in gross appearance a *Fabronia* or an *Amblystegiella*, but with leaves like miniature *Leucodon*. Indeed the leaf structure is difficult to distinguish from that of the flagella of *L. julaceus flagelliferus* and the author is inclined to believe that genuine *Habrodon perpusillus* (De-Not.) Lindb. does not occur in North America. No one has collected it since Sullivant's collection in Ohio. Specimens collected by Dr. Hague in Illinois were found mixed with *Leucodon julaceus* and have since been determined as flagella of that species. The resemblance is very close but the leaves of the *Leucodon* have in the median basal area a greater area of more elongated cells and the apical cells are elongated, while those of *Habrodon* are almost circular. The leaves in *Habrodon* are much more uniform than in *Leucodon*, in

which there are usually great differences in the basal and apical leaves of a flagellum. A photograph and a slide of Sullivant's original material have been loaned by the Farlow Cryptogamic Herbarium of Harvard University; these fully confirm the opinions expressed above.

5. MYRINIA Schimp. Syn. (Ed. 1) 482. 1860.

Tree growing mosses with the habit and appearance of *Leskea polycarpa*; tufts dark green; plants slender, without brood bodies; stems creeping, with few radicles; branches short and erect, not flagelliform; leaves spreading when moist, appressed when dry, acute to obtuse, entire; costa short, often thin; leaf cells oblong above, median rhombic, gradually longer toward the leaf base, rhombic-quadrate at basal angles and margins. Capsules erect or inclined, oblong-cylindric, nearly or quite symmetric, contracted under the mouth when dry; operculum conic; annulus lacking; peristome well developed, double with keeled segments as long as teeth and from a narrow basal membrane, cilia lacking. Type species *M. pulvinata*.

MYRINIA PULVINATA (Wahlenb.) Schimp. Syn. (Ed. 1) 483. 1860.

Leskea pulvinata Wahlenb. Flor. Lapp. 369. 1812.

Stem leaves ovate to broadly ovate-lanceolate, 0.7-1 mm. long; median leaf cells 12-15 x 25-45 μ ; inner perichaetial leaves linear-lanceolate, sheathing, reaching 2 mm. in length, narrowly obtuse. Other characters as above.

ILLUSTRATIONS:—Bry. Eur. pl. 471; Pl. 59.

Bases and roots of trees. A very rare moss of high altitudes and latitudes. British Columbia and northern Canada; Tobique River and Lac Bean, St. Francis River, New Brunswick.

MYRINIA (?) DIECKII R. & C. Bot. Centralbl. 44: 421. 1890.

This is not a *Myrinia* at all but a *Hygrohypnum* near *H. Smithii* (Sw.) Broth. The leaves are rather narrower, ovate to broadly ovate, none apparently sub-circular. Otherwise it agrees quite closely. A specimen at the New York Botanical Garden, apparently from the type collection, Mt. Hood, Oregon (Roell) has been studied. Until better and more abundant material is at hand it is scarcely worth while to attempt naming it.

6. SCHWETSCHKEOPSIS Broth. Engler & Prantl, Musci (Ed. 1) 877. 1907.

Only one species occurs in our range.

SCHWETSCHKEOPSIS DENTICULATA (Sull.) Broth. l. c.

Leskea denticulata Sull. Musc. Allegh. 62. 1845.

Plants small and very slender, in thin tufts, pale green, soft; stems prostrate, 2-4 cm. long, irregularly branched, without paraphyllia or central strand, somewhat flattened to subjulaceous; stem leaves close, erect-spreading, concave, very slightly decurrent, ovate to ovate-lanceolate, somewhat abruptly short-acuminate, 0.5-0.7 mm. long, mostly without any traces of costa; margins plane, slightly denticulate; branch leaves smaller, more gradually acuminate to acute; median leaf cells oblong-oval to oblong-linear, $\pm 7 \mu$ wide, 2-4 : 1, unipapillate on dorsal surface; alar abruptly quadrate and short-rectangular, occupying nearly the entire leaf base; marginal row quadrate to rhombic, extending nearly to base of acumination. Dioicous; seta smooth, 4-8 mm. long; capsule oblong-ovoid, nearly or quite erect and symmetric, 2-3 : 1; operculum rostrate; annulus lacking; peristome without cilia, the segments nearly as long and wide as the teeth, more or less open between the joints; calyptra cucullate. Type locality, Balsam Mt., N. Carolina. Type in the Herbarium of Harvard University.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 78; M. H. M. pl. 58.

EXSICCATI:—Drumm. Musc. Am. S. States 86 (as *Pterogonium filiforme* var. ?; Aust. Musc. Appal. 267; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 245, (Ed. 2) 347; R. & C. Musc. Am. Sept. Exsic. 85; Grout, N. Am. Musc. Pl. 134.

On base of trees, occasionally on rocks, rarely fruiting; sometimes flagelliferous. Connecticut to the Mississippi River and south to the Gulf.

Family FONTINALACEAE*

By DR. WINONA H. WELCH.

Plants aquatic, floating, attached at base of stems by a cushion of rhizoids, filiform to robust, colors ranging from various shades of green to reddish brown; some stems short but majority are much elongated, more or less denuded at base, irregularly or regularly pinnate; branches numerous, more or less fasciculate; leaves usually in three rows, distant to imbricate, costate or ecostate, more or less decurrent, subulate to almost orbicular, apices entire to microscopically denticulate, acute, subobtusate, obtuse, or more or less broadly obtuse; median leaf cells linear-rhomboidal or hexagonal-rhomboidal to linear-attenuate; alar cells rectangular, quadrate, or subhexagonal, auricles distinct to none. Dioicous (exceptionally monoicous or synoicous, according to Cardot); perichaetium oval, oblong, or cylindrical; calyptra cucullate or mitriform; capsule sessile or on seta of short to moderate length, completely immersed in the perichaetial leaves or partially or completely emergent, neck, annulus, and stomata lacking; operculum conical or rostrate; peristome double, the outer composed of 16 teeth, the inner of 16 cilia more or less completely united by transverse strands into a cone-like trellis.

The name is derived from the Latin, *fons, fontis*, fountain or spring. The family is truly called Water Mosses because the plants are submerged all the time or are attached to objects which are submerged during high water.

The family consists of six genera, three of which occur in North America north of Mexico.

*INTRODUCTORY NOTE.

The most complete study of the Fontinalaceae of North America was published in 1892 by Jules Cardot in *Monographie des Fontinalacées*. During the forty-two years which have passed, the collections of this group have increased greatly and the need of a revision of the family has become apparent. Cardot's monograph has served as a basis for the present study and all available specimens determined by Cardot have been carefully examined.

American students of mosses have had difficulty in using existing keys in Fontinalaceae because of the frequent use of fruiting characteristics in distinguishing the species and the varieties. Since many members of this family are rarely collected in fruit, I have made an attempt to prepare keys based upon vegetative distinctions, using the characteristics of the perichaetia and the capsules as additional differences in species which are rather frequently collected in the fruiting condition.

The study has been made in the Bryological section of the Long Island Biological Laboratory located at Newfane, Vermont, and in the Botanical Laboratories of DePauw University, Greencastle, Indiana.

ACKNOWLEDGMENTS.

I am especially indebted to Dr. A. J. Grout for the suggestion of the problem, for his valuable advice and criticism, for the use of his large collection of Fontinalaceae, including *Husnot*, *Musci Galliae*, and *Brotherus*, *Bryotheca Fennica*, and for the arrangement of the illustrations and the preparation of the plates. For the courtesy of the loan of extensive collections of Fontinalaceae in their charge, I am very grateful to Dr. W. R. Maxon and Mr. E. C. Leonard of the United States National Herbarium, to Prof. G. E. Nichols and Prof. H. Castle of Yale University, to Prof. W. H. Weston and Mrs. Gertrude H. Riddle of the Farlow Herbarium, Harvard University, to Mr. R. S. Williams of the New York Botanical Garden, to the late Dr. M. O. Malte of the National Herbarium of Canada, to Mr. A. J. Sharp of the University of Tennessee, to Prof. C. L. Porter of the University of Wyoming, and to Dr. C. C. Deam, Bluffton, Indiana. A few of the important American exsiccata which have been available through these herbaria are *Austin*, *Musci Appalachiani*, *Sullivan* and *Lesquereux*, *Musci borealo-americani*, *Sullivan*, *Musci Alleghaniensis*, *Grout*, *North American Musci Pleurocarpi*, *Grout*, *Musci Perfecti*, *Macoun*, *Canadian Musci*, and *F. Renaud* and *J. Cardot*, *Musci Americae Septentrionalis*. I wish to express, also, my deep appreciation to Directeur Pierre Allorge of the Herbarium, Laboratoire de Cryptogamie, Muséum d'Histoire Naturelle, Paris, for the use of a large number of J. Cardot's types and duplicate types. My gratitude is due also to Dr. John Hendley Barnhart, New York Botanical Garden, for checking a large number of citations. For information concerning specific specimens I greatly appreciate the correspondence of Prof. T. C. Frye, University of Washington, Prof. J. C. Arthur, Purdue University, and the Rev. C. H. Demetrio, Memphis, Tennessee. I am especially thankful to Prof. T. G. Yuncker, DePauw University, for his very helpful suggestions, for the availability of the necessary laboratory equipment, and for the use of the Fontinalaceae of the J. P. Naylor Herbarium. To Mr. William D. Gray, a graduate student in Botany, DePauw University, I express my sincere thanks and appreciation for his splendid coöperation, care, accuracy, and skill in preparing the many drawings both original and copied.

The keys are based chiefly upon vegetative characteristics because the plants are collected very frequently without fruits. The family and the genera are rather easily recognized, especially if fruiting specimens are available, but the species are very difficult to separate because of the similarity in fruits and in the areolation of the leaves and the variation in leaf size and form on the same plant. So far as possible the use of characteristics which may be produced or modified by habitat conditions has been avoided. The decisions concerning relationships between species and varieties have been made very largely upon fruit characteristics whenever the fruits or the descriptions were accessible.

KEY TO THE GENERA OF FONTINALACEAE.

- | | |
|---|------------------------|
| 1. Leaves ecostate..... | 1. <i>Fontinalis</i> . |
| Leaves costate..... | 2. |
| 2. Leaves narrowly lanceolate, secund to falcate-secund; perichaetium very long, cylindric; seta of medium length, longer or shorter than the perichaetium..... | 3. <i>Dichelyma</i> . |
| Leaves oblong-lanceolate, neither secund nor falcate-secund; perichaetium oblong; seta very short, completely immersed..... | 2. <i>Brachelyma</i> . |

1. FONTINALIS [Dill., L.] emend. Myrin, Act. Reg. Acad. Scient. Holm. 1832.

Plants aquatic, slender to very robust; stems usually denuded toward base, more or less elongated, freely branched; leaves tristichous, ecostate, carinate, keeled-conduplicate, concave, plane, or more or less canaliculate or tubular, shapes varying from nearly subulate or narrowly lanceolate to almost orbicular; apices entire, or microscopically subdenticulate or denticulate, acute, subobtuse to more or less broadly obtuse; median leaf cells linear or linear-rhomboidal; alar cells rectangular, quadrate, or subhexagonal, forming more or less distinct auricles; perichaetium oval, oblong, or cylindrical; perichaetial leaves oval to suborbicular or oval-oblong, truncate, rounded, or apiculate, entire, more or less lacerate with age. Capsule sessile, completely immersed to about one-half emergent; calyptra conical, base lacerate with age, extending to the base of the capsule or slightly below; operculum conical; peristome double, orange to brownish, outer peristome of 16 distinctly lamellate teeth, often united in pairs at the apex, inner peristome of 16 cilia, about same length as teeth, united by transverse strands into a cone-like trellis; spores varying in size, usually green, smooth or muricate.

KEY TO SECTIONS OF FONTINALIS.

- | | |
|---|----------------------------|
| 1. Older cauline leaves typically keeled or keeled-conduplicate, younger cauline leaves and branch leaves keeled, keeled-conduplicate, or concave..... | A. <i>Tropidophyllae</i> . |
| Neither cauline nor branch leaves keeled-conduplicate..... | 2. |
| 2. Leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent..... | B. <i>Heterophyllae</i> . |
| Leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present (except in <i>Novae Angliae</i> , var. <i>heterophylla</i>)..... | 3. |
| 3. Cauline leaves more or less concave or channeled, majority more or less firm..... | 4. |
| Cauline leaves slightly concave or almost plane, majority more or less flaccid..... | D. <i>Malacophyllae</i> . |
| 4. Cauline leaves ovate-lanceolate or oblong-lanceolate, some narrowly lanceolate.... | C. <i>Lepidophyllae</i> . |
| Cauline leaves linear-lanceolate..... | 5. |
| 5. Plants very slender, very delicate, more or less filiform; leaves very concave, tubular, or subtubular..... | F. <i>Solenophyllae</i> . |
| Plants slender, delicate, but scarcely filiform; leaves long and narrowly acuminate, more or less channeled..... | E. <i>Stenophyllae</i> . |

Sect. A. TROPIDOPHYLLAE Card. Mon. Font. 48. 1892.

Older cauline leaves typically keeled or keeled-conduplicate, younger cauline leaves and branch leaves keeled, keeled-conduplicate, or concave, leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present, or leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent; perichaetium oval or oblong. With the exception of *F. antipyretica* var. *gigantea* the members of this section are more common in western United States and Canada than in the eastern part.

KEY

1. Leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present. 2.
 Leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent. 7.
2. Leaves with keels more or less curved above the basal curve. 3.
 Leaves with keels more or less straight above the basal curve; some apices more or less shortly and abruptly curved. 6.
3. Leaves ovate, oval, or almost orbicular, 1-2 : 1; apices more or less broadly obtuse, those of the cauline leaves usually more or less abruptly narrowed, those of branch leaves generally gradually narrowed, some more or less cucullate. 4.
 Leaves oblong-lanceolate, oval-lanceolate, or ovate-lanceolate, 1.5-3 : 1; apices acute, subobtuse, or more or less narrowly obtuse. 5.
4. Plants robust, cauline leaves 4-8 mm. long, 3-6 mm. wide. 1a. *antipyretica*, var. *gigantea*.
 Plants less robust, cauline leaves 3.5-5 mm. long, 1.5-4.5 mm. wide. 1b. *antipyretica*, var. *mollis*.
5. Cauline leaves ovate-lanceolate or oval-lanceolate, 5-8 mm. long, 2-4 mm. wide, approximately 2-3 : 1; apices usually more or less obtuse, some acute, median leaf cells linear-rhomboidal, 6-15 : 1; perichaetial leaves oval or suborbicular, obtuse. 1. *antipyretica*.
 Cauline leaves oblong-lanceolate, 2.5-5 mm. long, 1-3 mm. wide, 1.5-3 : 1; apices frequently acute, some more or less obtuse, median leaf cells linear, 10-25 : 1; perichaetial leaves broadly oval-lanceolate, abruptly apiculate. 2. *neo-mexicana*.
6. Cauline leaves lanceolate, 3.5-5 mm. long, 0.75-2 mm. wide, 2.5-4 : 1; apices gradually narrowed, more or less obtuse and conduplicate. 1c. *antipyretica*, var. *oreganensis*.
 Cauline leaves ovate-lanceolate, 4-6 mm. long, 1.5-2.5 mm. wide, 2-3 : 1; apices more or less abruptly narrowed, short, broad, and open. 1d. *antipyretica*, var. *patula*.
7. Cauline leaves narrowly lanceolate, narrowly acuminate, 4-5.5 mm. long, 0.50-1 mm. wide, 6-8 : 1; branch leaves very narrowly lanceolate, long and narrowly acuminate, almost awl-shaped, 3-5 mm. long, 0.25-0.60 mm. wide, 8-18 : 1. 5. *chrysophylla*.
 Cauline leaves broadly ovate-lanceolate or oval-lanceolate; branch leaves narrowly lanceolate, narrowly ovate-lanceolate or oblong-lanceolate. 8.
8. Plants more or less dendroid in appearance; upper cauline leaves more or less shortly and narrowly acuminate, 5-7 mm. long, 1.5-3 mm. wide, 2-3 : 1; branch leaves narrowly lanceolate, long-acuminate, canaliculate or more or less tubular toward apex, 3-4 mm. long, 1-1.5 mm. wide, 3-4 : 1. 4. *Howellii*.
 Plants not dendroid in appearance; upper cauline leaves more or less longly and narrowly acuminate, 5-7 mm. long, 1.5-3 mm. wide, 1.5-3 : 1; branch leaves narrowly ovate-lanceolate or oblong-lanceolate, long-acuminate, canaliculate toward apex, 3-6 mm. long, 1-2 mm. wide, 2-3 : 1. 3. *Kindbergii*.

1. FONTINALIS ANTIPYRETICA [L.] Hedw. Sp. Musc. 298. 1801.

Fontinalis trifaria Voit. Muscol. Herb. 125. 1812.

Pilotrichum antipyreticum C. Müll. Syn. 2: 148. 1850.

Fontinalis californica Sull. Pacif. R. R. Rep. 4: 189. 1857.

Fontinalis antipyretica L., var. *californica* (Sull.) Lesq. ms. in herb., according to Cardot.

Plants more or less slender, commonly dark green, glossy or dull, sometimes yellowish-green, olive-green, brownish-green, coppery brown, golden-brown, may become blackish with age; stems usually more or less rigid, up to 50 cm. in length, rarely 70 cm., generally denuded at base; branching pinnate, generally more or less flaccid if young and long; leaves spreading or loosely imbricate at ends of stems and branches, usually more or less distant, 1-2 mm. apart, keeled-conduplicate with keel commonly curved, oval- or ovate-lanceolate, variously acuminate, apices usually more or less obtuse, some acute, entire, sinuate, or denticulate, with margins on one side (seldom both sides) frequently reflexed near base, 5-8 mm. long, 2-4 mm. wide, approximately 2-3 : 1; median leaf cells linear-rhomboidal to hexagonal, 10-15 μ wide, 6-15 : 1; alar cells enlarged, more or less rectangular, quadrate, or hexagonal, sometimes as many as 13 vertical rows of cells in the alar group, walls yellowish or brown, generally forming distinct auricles; perichaetial leaves oval or suborbicular, obtuse, entire, usually lacerate with age. Capsule usually immersed, rarely half emergent, more or less oval, 2-3 mm. long, 1-1.5 mm. in diameter; operculum short-conical, about 1 mm. long; peristome orange-brownish, teeth linear, approximately 1 mm. long, often united in pairs at the apex, papillose, with 25-35 lamellae; inner peristome perfect, papillose, transverse bars more or less appendiculate; spores olive-green or yellowish-green, slightly muricate, 15-18 μ in diameter, ripe in summer. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 429; Limpr., Laubm. 3: figs. 325 & 326; Engler & Prantl (Ed. 2) 11: fig. 474; Arkiv för Botanik 17, No. 14, figs. 1 & 2; M.H.M. pl. 88a; Pl. 74.

EXSICCATI:—Sull. & Lesq. Musci Bor. Am. (Ed. 2) 333; Foster, 1430, Ore.; Baker, 3000, Cal.; Bolander, 333, 952, Cal.; Grout, Tolland, Colo., July 28, 1914; Wright, 334, N. Mex.; (Macoun?), Canadian Musci, 228.

In ponds and streams, United States and Canada. According to Cardot, also in Greenland, Europe, Asia, and Africa. The varieties of *antipyretica* are more common in North America than is the species. All varieties, except *gigantea*, occur more frequently in western United States and Canada than in the eastern part.

The species may be distinguished by leaves generally more or less distant, keeled-conduplicate with keels commonly curved, oval- or ovate-lanceolate, approximately 2-3 : 1, margins on one side frequently reflexed near base, many apices short and more or less narrow, obtuse, denticulate; median leaf cells short, linear-rhomboidal to hexagonal, and capsules oval or oval-oblong.

According to Cardot, Linnaeus gave the specific name *antipyretica* to this moss because the peasants of Sweden surrounded the chimneys of their houses with it for the prevention of fire.

1a. Var. GIGANTEA Sull. Icon. Musc. 106. 1864.

Fontinalis gigantea Sull. Musci U. S. 104. 1856.

Fontinalis antipyretica L., var. *robusta* Card. Rev. Bryol. 9: 88. 1882.

Plants moderately to very robust, green, brownish-green, golden-green, or copper-brown; cauline leaves more or less imbricate or erect-spreading, keeled-conduplicate, keel commonly curved, ovate, broadly ovate, lance-ovate, oval, or almost orbicular, frequently margins on one side reflexed near base, large, 4-8 mm. long, 3-6 mm. wide, approximately 1-2 : 1; apices gradually or more or less abruptly narrowed, usually more or less broadly obtuse, sometimes acute, entire, subdenticulate, or denticulate; median leaf cells 10-20 μ wide, 7-11 : 1; peristome teeth smooth or only slightly papillose; trellis of inner peristome often imperfect, slightly muricate, transverse bars not appendiculate or only slightly so.

Type locality, New England.

ILLUSTRATIONS:—Sull. Icon. Musc. pl. 66; Grout, M.H.M. pl. 88d; Pl. 74.

EXSICCATI:—Austin, Musci Appal. 243; Sull. & Lesq. Musci Bor. Am. (Ed. 1) 224, (Ed. 2) 335 in part; Grout, N. Am. Musc. Pl. 137, Conn., 281, Vt.; Delamare, R. & C., Musci Am. Sept. 71, Miquelon; G. K. Merrill, 184, Me.; E. D. Merrill, Flora of Maine, 68; Welch, 711, Vt.; Grout, Cold Spring Harbor, N. Y., July 5, 1929; E. G. Britton, Pa., July 3, 1899; Burnett & Gates, 1704, Pa.; Small, Pa. Mosses, Sept. 2-5, 1889; Holzinger & Elftman, Mosses of northern Minn., June 21, 1897; Aven Nelson, 8521, Wyo.; Heller, Idaho Plants, 3450; Allen, Mosses of Cascade Mts., 82, Wash.; Macoun, Canadian Musci, 598a, N. S.; 757, Ont.; 3, Vancouver Id.; Waghorne, Canadian Musci, Nfld., July 24, 1890.

In streams and ponds, Canada, Miquelon, and northern United States across the continent. Europe. According to Jennings (Manual Mosses of Western Pennsylvania), also in "Asia, northern Africa and from Canada through the United States to Alabama." I have seen no specimens collected south of Pennsylvania. From specimens examined, I have concluded that var. *gigantea* occurs more frequently in eastern United States than in the western part.

The var. *gigantea* differs from *antipyretica* in being commonly more robust, cauline leaves usually closely imbricate or subimbricate, ovate, oval, or almost orbicular, and apices more or less broadly obtuse.

1b. Var. *MOLLIS* (C. Müll.) n. comb.

Fontinalis mollis C. Müll. Bot. Centralbl. 44: 421. 1890.

Plants more or less slender, green, yellowish-green; stems more or less soft, slightly denuded below, irregularly pinnate; cauline leaves erect-spreading or loosely imbricate, *keeled-conduplicate or very concave with keels curved, ovate, oval, or almost orbicular*, with apices gradually narrowed or more or less abruptly narrowed, obtuse to more or less broadly obtuse, sometimes slightly cucullate to cucullate, entire, sinuate, subdenticulate, or denticulate, 3.5–5 mm. long, 1.5–4.5 mm. wide, 1–2 : 1; median leaf cells linear-rhombic, 10–17 μ wide, 6–15 : 1; alar cells enlarged, rectangular, quadrate, or subhexagonal, greenish, yellowish, brownish, brown, or yellowish-brown, frequently forming distinct auricles. According to C. Müller and Cardot, the upper perichaetial leaves are oval-suborbicular, truncate, lacerate at apex with age. *Capsule* completely immersed, *oval*, 1.75–2 mm. long, 1 mm. in diameter; operculum obtuse, conical; peristome orange-brownish, teeth linear-acuminate, about 1 mm. long, slightly papillose, with 28–32 lamellae, usually united in pairs at apex; inner peristome imperfect, muricate, transverse bars nodulose or appendiculate, usually incomplete; spores green, slightly muricate.

Type locality, Astoria, Washington; collected by Röhl.

ILLUSTRATIONS:—Pl. 74.

EXSICCATI:—Röhl, 292, Astoria, Wash., type or duplicate type in Herbarium of the New York Botanical Garden; Foster, 439B, Wash.; Aven Nelson, Plants of Wyoming, 9670; Porter, Bryophytes of Wyoming, 1437; Macoun, Canadian Musci, 598e, Vancouver Id.

In rivers, in western United States and Canada.

This variety differs from *antipyretica* in having leaves ovate, oval, or almost orbicular, apices broad, obtuse, frequently more or less cucullate; from var. *gigantea* in plants commonly less robust, leaves usually smaller, frequently more or less cucullate.

F. antipyretica var. *pseudomollis* Card. has been found on one collection. The name is not considered as a synonym because no publication of the description has been found. The specimens are included in the exsiccati of *F. antipyretica* var. *mollis*.

F. patens Card. and *F. antipyretica patens* R. & C. occur on packets of material collected in same locality. The names have been omitted from synonymy after a careful search in literature for the descriptions. The plants agree with the description of *F. antipyretica* var. *mollis* and have been included in the exsiccati of this variety.

Fontinalis utahensis Card. & Thér. Arch. de Bot. 1: 67. f. 1. 1927. No material of this species has been obtainable. From a study of the original description I have concluded that it seems to be more closely related to var. *mollis* than to the other species in this section.

1c. Var. *OREGANENSIS* R. & C. Rev. Bryol. 15: 71. 1888.

Fontinalis rigens Ren. & Card. Bot. Centralbl. 44: 421. 1890.

Many plants slender, some more or less robust, golden, yellowish-green, brownish-green, olive-green, of copper-color, usually glossy in upper portions and dull in lower; stems more or less flaccid and foliate to base when young, more or less rigid and denuded at base when older, pinnately branched; branches distant, spreading; leaves firm, rather distant, spreading or erect-spreading, imbricate toward ends of stems and branches, *keeled-conduplicate with keels not curved above basal curve or only slightly so*, some shortly and more or less abruptly curved at apex, some with one or both margins reflexed near base, *lanceolate, gradually narrowed toward apex*, many apices obtuse or subobtuse, some acute, many denticulate, some entire, 3.5–5 mm. long, some 6.5 mm. in length, 0.75–2 mm. wide, few 2.5 mm. in width, 2.5–4 : 1; median leaf cells linear, 6.5–13.5 μ wide, 8–16 : 1; alar cells enlarged and very evident, sometimes as many as 13 vertical rows, rectangular to subhexagonal, walls brown or yellowish-brown, frequently forming distinct auricles; fruits similar to those in *antipyretica*, except capsules frequently $\frac{1}{2}$ emergent, and constricted beneath mouth when dry.

Type locality, Oregon; collected by Th. Howell.

ILLUSTRATIONS:—Pl. 74.

EXSICCATI:—Howell, 19, Oregon, in swamps on roots of trees, etc., top of Coast Mts., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; Grout, N. Am. Musc. Pl. 210, 437, Washington, and 91, 140, British Columbia; Foster, 747, 907c, 1529, Wash.; Nelson, Flora of Wyoming, 2619; Spreadborough, Plants of Queen Charlotte Islands, Canada, 83366; Hill, July 10, 1903, B. C.; Mr. & Mrs. E. P. Walker, Bryophytes of Alaska, 902; Macoun, Canadian Musci, 9, 598d, Vancouver Id.; 208, B. C.

In swamps, sloughs, pools, ponds, and canals, in western United States and Canada, and in Alaska.

This variety differs from *antipyretica* in leaves usually shorter, narrower, 2.5-4 : 1, lanceolate, gradually narrowed toward apex, keels straight or only slightly curved, median leaf cells linear.

I have examined *Fontinalis angustifolia* Card. sp. nova, collected by Foster, no. 907b, in Quinault Indian Agency, Washington, May 24, 1909. I consider the material as belonging to *F. antipyretica*, var. *oreganensis*. The search for the original description was unsuccessful.

I have studied material labeled *Fontinalis Fosteri* Cardot sp. nova, no. 1821, which was collected by Foster on margin of Lake Crescent, Wash., Aug. 11, 1911. I consider the plants as belonging to *F. antipyretica*, var. *oreganensis*. I have been unable to locate the original description.

Id. Var. *PATULA* (Card.) n. comb.

Fontinalis patula Card. Rev. Bryol. 23: 67. 1896.

Plants more or less robust, green, yellowish-green, or brownish, more or less glossy; stems more or less rigid, 20-25 cm. in length, foliate to base or slightly denuded, irregularly branching; branches more or less elongate; leaves spreading or erect-spreading, distant, more or less imbricate at ends of stems and branches, *keeled-conduplicate, or carinate and open, or concave, keels or median lines straight above basal curve or only very slightly curved*, some shortly and more or less abruptly curved at apex, many leaves split along keel, ovate-lanceolate to broadly ovate-lanceolate, *apices broad and short, majority more or less open*, acute, subobtusate, obtuse, entire to denticulate, 4-6 mm. long, 1.5-2.5 mm. wide, 2-3 : 1, in robust plants some leaves up to 7.5 mm. in length, 4 mm. in width, 1.5-2.5 : 1; *median leaf cells linear*, 8.5-15 μ wide, up to 24 μ in width in robust plants, 10-20 : 1; alar cells enlarged, subrectangular, rectangular, or subhexagonal, brownish or yellowish-brown. According to Cardot, the perichaetial leaves broadly ovate-suborbicular, apices rounded, lacerate with age; *capsule* immersed, *oblong-subcylindric*, 2.5-3 mm. long, 0.75-1 mm. in diameter, operculum obtuse-conical; peristome orange-brownish, teeth linear, up to 1.5 mm. in length, often united in pairs at apex, slightly papillose, *40-50 lamellae*; inner peristome perfect, muricate, lower transverse bars appendiculate; spores green, minutely granulose.

Type locality, Vancouver Island, Canada, "On stones in the Colquity River near Victoria"; collected by Macoun, May 25, 1893.

ILLUSTRATIONS:—Pl. 74.

EXSICCATI:—Macoun, Colquity River, near Victoria, B. C., May 25, 1893, assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; Macoun, Canadian Musci, 208, 368, B. C., 104, Vancouver Id., sheet no. 3928 in National Museum of Canada, V. I.; Grout, N. Am. Musc. Pl. 158, B. C.; 144, Wash.; Piper, 37, Wash.; Grant, Marysville, Wash., July, 1927.

In rivers, lakes, or pools, in Washington and British Columbia.

This variety differs from the species in keel straight above basal curve or almost so, apices broad, short, and usually more or less open, capsules oblong-subcylindric, some peristome teeth longer, and lamellae more numerous.

I have studied material labeled *Fontinalis Fosteri* Cardot sp. nova, no. 1046, which was collected by Foster in Mt. Rainier National Park, Wash., Aug. 9, 1909. I consider the specimens as *F. antipyretica*, var. *patula*.

2. FONTINALIS NEO-MEXICANA Sull. & Lesq. Musc. Bor. Am. (Ed. 1) No. 224b. 1856.

Fontinalis mercediana Lesq. Proc. Cal. Acad. 1: 28. 1868.

Fontinalis columbica Card. Rev. Bryol. 18: 82, 84. 1891.

Fontinalis neo-mexicana Sull. & Lesq., var. *columbica* Card. Mon. Font. 61. 1892.

Plants slender, dull green, vivid green, or yellowish, sometimes golden brown, brownish, or blackish, frequently glossy when dry; stems more or less rigid, 20-50 cm. long, denuded and blackish at base with age, pinnately branched; branches numerous, more or less flaccid, spreading or ascending; leaves commonly rather close, sometimes more or less distant, imbricate at ends of stems and branches, firm, spreading or erect-spreading, *keeled-conduplicate, keel slightly curved* and often split, *oblong-lanceolate*, with many apices acute, some more or less obtuse, entire or denticulate, 2.5-5 mm. long, 1-3 mm. wide, 1.5-3 : 1; *median leaf cells linear*, 5-15 μ wide, 10-25 : 1; alar cells slightly enlarged, sometimes as many as 8 vertical rows of cells in the alar group, rectangular to quadrate, walls hyaline to yellowish in younger leaves and brown to ferruginous in older leaves; *upper perichaetial leaves broadly oval-lanceolate, abruptly apiculate*, lacerate with age. Capsule immersed, *ovate-oblong*, 2-2.5 mm. long, 1-1.25 mm. in diameter; operculum conical, obtuse; peristome teeth orange-brownish, 20-25 lamellae, very papillose, trellis of inner peristome perfect, papillose, many transverse bars appendiculate.

Type locality, New Mexico; collected by Wright.

ILLUSTRATIONS:—Sull., *Icones Musc. pl.* 57; *Pl.* 73 & 74.

EXSICCATI:—*Austin*, *Musc. Appal.* 251b, N. Mex.; *Sullivan & Lesquereux*, *Musc. Bor. Am.* (Ed. 1). 224b, duplicate type, (Ed. 2) No. 334; *Grout*, N. Am. *Musc. Pl.* 84, B. C. and 263, Mont.; *Allen*, *Mosses Cascade Mts.*, 80, Wash.; *Piper*, 83, Wash.; *Bailey*, B. C., June, 1907; Wash., Sept. 1, 1907; *Grant*, Wash., October, 1926; *Foster*, 439, 967, Wash.; *Clackamas Co.*, Ore., June 17, 1907; *Craig*, 14, Ore.; *M. A. Howe*, R. & C., *Musc. Am.* Sept. 314, Cal.; *Elmer*, Idaho, June, 1899; *MacFadden*, 8910, Cal.; 1116, B. C.; *Slocan Lake*, B. C., April 7, 1926; *Umbach*, 869, Mont.; *Aven & Elias Nelson*, 6293, Wyo.; *Aven Nelson*, *Bryophytes of Wyoming*, 6293, 9669; *Flora of Wyoming*, 8511; *Goodding*, *Plants of Colorado*, 1851; *Standley*, *National Forest*, N. Mex., July 30, 1908; *Macoun*, *Canadian Musci*, 103, 599, B. C.; *Spreadborough*, 83367, Queen Charlotte Islands, Canada.

In streams of the Rocky Mountain and Pacific Coast states.

F. neo-mexicana differs from *F. antipyretica* in the leaves ovate-lanceolate, apices commonly acute, the upper perichaetial leaves broadly oval-lanceolate and abruptly apiculate.

Fontinalis maritima C. Müll. *Flora* 70: 225. 1887.

Cardot in *Monographie des Fontinalacées*, page 62, suggested that *F. maritima* might be a variety of *F. neo-mexicana*. My efforts to obtain authentic material of *F. maritima* have been unsuccessful. Prof. T. C. Frye, Dep't of Botany, University of Washington, stated in a letter, June 6, 1933, that in 1914 he camped for one week at Neah Bay with the express purpose of collecting this moss and that he found nothing like it in the sea water. I have not seen the type or any specimen determined by Cardot as being *F. maritima*. From Cardot's description I have assumed that *F. maritima* might be a synonym or a variety of *F. neo-mexicana* and that the plant might have floated down from fresh water.

3. FONTINALIS KINDBERGII R. & C. *Bot. Gaz.* 15: 58. 1890.

Fontinalis antipyretica L., var. *ambigua* Card. *Rev. Bryol.* 18: 82. 1891.

Fontinalis subbiformis R. & C. in litt., according to Cardot.

Fontinalis Kindbergii R. & C., f. *robustior* Card. *Mon. Font.* 64. 1892.

Fontinalis Kindbergii R. & C., f. *gracilior* Card. *Mon. Font.* 65. 1892.

Plants more or less robust, ferruginous, golden, reddish, or copper-color, glossy above; stems more or less rigid, up to 30 cm. or more in length, commonly denuded and blackish near the base, more or less pinnately branched; branches erect or spreading, more or less rigid, commonly plumose; leaves dimorphic; keels straight above the basal curve or only slightly curved, sometimes a short and more or less abrupt curve at the apex; cauline leaves erect-spreading or loosely imbricate, more or less distinctly carinate or only folded, more commonly open than conduplicate, broadly ovate-lanceolate or oval-lanceolate, more or less long and narrowly acuminate, apices acute or obtuse, entire or denticulate, sometimes margins on both sides slightly involute, the upper 5-7 mm. long, usually 1.5-3 mm. wide, some up to 4 mm. in width, 1.5-3 : 1, the lower smaller and shorter-acuminate; branch leaves erect-spreading, rarely imbricate, concave, folded or subcarinate, canaliculate toward apex, narrowly ovate-lanceolate or oblong-lanceolate, long-acuminate, margins slightly involute, 3-6 mm. long, 1-2 mm. wide, 2-3 : 1; median leaf cells linear-rhomboidal to linear, 8.5-20 μ wide, 10-25 : 1; alar cells enlarged, more or less rectangular, quadrate, or hexagonal, walls yellowish or brownish, generally forming distinct auricles; perichaetial leaves suborbicular, apices rounded, entire, usually lacerate with age. Capsule immersed, oblong to subcylindric, 2-2.5 mm. long, 0.5-0.9 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear, slightly papillose, with 20-35 lamellae; lattice cone of inner peristome perfect, papillose, transverse bars appendiculate; spores yellowish-green, muricate, 15-18 μ in diameter.

Type locality, Vancouver Island (*Macoun*).

ILLUSTRATIONS:—*Bot. Gaz.* 15: *pl.* 94; *Arkiv. för Botanik* 17, no. 14, *figs.* 15 & 16, *pl.* 6, no. 11; *Pl.* 73.

EXSICCATI:—*Allen*, *Mosses Cascade Mts.*, 81a & 81b, Wash.; *Foster*, 1045; 1428 in part, 1429, Wash.; *Piper*, 37, Wash.; *Macoun*, *Canadian Musci*, 133, 233, 251, 598b, Vancouver Id.; 598, N. S.; *J. W. Bailey*, *Cumberland*, B. C., June, 1901.

In streams, lakes, and ponds of United States and Canada, in and west of the Rocky Mountains; also in Nova Scotia. Europe.

This species differs from *antipyretica* in the branches usually more or less plumose, the leaves dimorphic and more or less long and narrowly acuminate, the keels straight above the basal curve or only slightly curved, and the capsules narrower, oblong to subcylindric.

The robust forms are distinguished by Cardot as forma *robustior* and the slender forms as var. *gracilis* and forma *gracilior*. I have been unable to obtain type material of this variety and these forms. As these names indicate, there is a wide variation in the size of the plants and the leaves. However, since aquatic mosses are frequently modified in size and form by changes in the habitat, I have placed *F. Kindbergii* Ren. & Card., f. *robustior* Card. and *F. Kindbergii* Ren. & Card., f. *gracilior* Card. in synonymy. Since I have found *F. Kindbergii* Ren. & Card., var. *gracilis* Card. on herbarium packets and not in print, I have omitted this name in the synonyms.

4. FONTINALIS HOWELLII R. & C. Bot. Gaz. 13: 200. 1888.

Plants rigid, yellowish green or dull green, *more or less dendroid* in appearance; stems 10–20 cm. long, rigid, subligneous, denuded below, pinnate to bipinnate; *branches spreading, commonly very plumose, generally arcuate; leaves firm and very dimorphic; cauline leaves* gradually larger toward the top of the innovations, commonly erect and imbricate, *broadly ovate-lanceolate, more or less short and narrowly acuminate*, carinate, subcarinate, concave or only plicate, with apices entire or subdenticulate, often slightly cucullate or lacerate; upper leaves 5–7 mm. long, 1.5–3 mm. wide, 2–3 : 1; lower leaves much smaller; *branch leaves narrowly lanceolate; long-acuminate, canaliculate or more or less tubular toward apices*, concave, not carinate, rigid, erect-spreading, 3–4 mm. long, some up to 6 mm. in length, 1–1.5 mm. wide, 3–4 : 1; median leaf cells linear, attenuate, 8.5–17 μ wide, 15–25 : 1; alar cells enlarged, quadrate, rectangular, or subhexagonal, yellowish, brownish, or ferruginous. According to Renauld and Cardot, the perichaetial leaves are oval, rounded or truncate at apex, finally lacerate; *capsule* immersed, *oblong or subcylindric*, 2 mm. long, 0.50–0.75 mm. in diameter; operculum unknown; teeth about 1 mm. long, narrow, linear-acuminate, slightly papillose, often connected in pairs at the apex, with 20–30 lamellae; trellis of the inner peristome strongly papillose, the lower transverse bars appendiculate.

Type locality, Oregon; collected by Th. Howell.

ILLUSTRATIONS:—Bot. Gaz. 13: *pl. 18; Pl. 73.*

EXSICCATI:—Howell, 20, Ore., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; 33, Ore.; Allen, near Mt. Rainier, Wash., Feb. 11, 1898; Flett, Mt. Rainier, Wash., July 26, 1914.

In pools, ponds, and swamps, in Oregon and Washington.

F. Howellii resembles *F. Kindbergii* rather closely. *F. Howellii* is usually very rigid, more or less dendroid in appearance, branches frequently arcuate, dimorphism is very pronounced, the broadly ovate-lanceolate cauline leaves are more or less shortly and narrowly acuminate, and the branch leaves are canaliculate or more or less tubular toward the apices.

5. FONTINALIS CHRYSOPHYLLA Card. Rev. Bryol. 18: 82 & 84. 1891.

Plants more or less slender, glossy, ferruginous, reddish, or golden yellow, sometimes brownish below; stems more or less rigid, approximately 15–20 cm. in length, denuded near the base, pinnately branched; branches spreading, plumose; leaves remote, firm, spreading or erect-spreading, *slightly dimorphic*, concave, subcarinate, carinate, or keeled-conduplicate, *median line usually straight above the basal curve or almost so*; apices obtuse, subobtusate, or acute, entire, subdenticulate, or denticulate; *cauline leaves narrowly lanceolate, narrowly acuminate*, 4–5.5 mm. long, 0.50–1 mm. wide, 6–8 : 1; *branch leaves and leaves of the innovations very narrowly lanceolate, longly and narrowly acuminate, almost awl-shaped*, some of the apices canaliculate, some tubular, some almost plane, 3–5 mm. long, 0.20–0.60 mm. wide, 8–18 : 1; median leaf cells linear, 6.8–8.5 μ wide, 15–30 : 1; alar cells enlarged, quadrate, subrectangular, subhexagonal, brown or yellow, forming distinct auricles. According to Cardot, the *capsule* is completely immersed, *oblong to subcylindric*.

Type locality, Washington, Olympic Mts.; collected by L. F. Henderson.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—Henderson, 1907, Wash., Olympic Mts., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; Foster, near Summit, Wash., 4807 in Herb. of E. B. Chamberlain now in Farlow Herbarium, also in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris.

In mountain bogs and streams, Washington.

This species differs from *F. Kindbergii* in all leaves remote, erect-spreading or spreading, cauline leaves narrowly lanceolate, branch leaves and leaves of the innovations very narrowly lanceolate, almost awl-shaped.

Sect. B. HETEROPHYLLAE Card. Mon. Font. 72. 1892.

Leaves dimorphic (cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent), cauline leaves, [both young (vernal) and adult (aestival) leaves of *F. biformis* are included here], firm or flaccid, distant to loosely imbricate, concave or subconcave at base, concave, subconcave, canaliculate, subtubular, or plane above, narrowly or broadly lanceolate, oblong-lanceolate, narrowly or broadly ovate-lanceolate, oval-lanceolate, or suborbicular, gradually acuminate, branch leaves smaller, firm or flaccid, subconcave or concave at base, canaliculate, subcanaliculate, subtubular, tubular, or plane

above, narrowly lanceolate or narrowly oblong-lanceolate, gradually acuminate. The common range of members of this section is the eastern half of the United States.

KEY.

1. Plants with young (vernal) and adult (aestival) forms; young or vernal leaves flaccid, concave, broadly ovate-lanceolate to suborbicular, 4-5 mm. long, 2-3.5 mm. wide; apical cells more or less sphagniform; adult or aestival leaves firm, narrowly lanceolate, canaliculate or subtubular, 2-3.5 mm. long, 0.50-0.75 mm. wide; apical cells more or less sphagniform. 6. *biformis*.
 Plants not showing distinct changes with age or seasons; cauline leaves narrowly lanceolate to broadly lanceolate or oblong-lanceolate, 3-8 mm. long, 0.5-2 mm. wide; apical cells not sphagniform. 2.
2. Stems more or less flaccid; leaves rather indistinctly dimorphic, cauline slightly concave at base, plane above, narrowly or broadly lanceolate or oblong-lanceolate, 3.5-6.5 mm. long, 1-2 mm. wide. 9. *missourica*.
 Stems more or less rigid; leaves distinctly dimorphic, cauline moderately concave, narrowly lanceolate or narrowly ovate-lanceolate, long and narrowly acuminate, 3-8 mm. long, about 0.5-2 mm. wide. 3.
3. Cauline leaves more or less firm, narrowly lanceolate, 4-5.5 mm. long, about 1 mm. wide, usually about 1-1.5 times the length of the branch leaves. 7. *disticha*.
 Cauline leaves flaccid, narrowly lanceolate to narrowly ovate-lanceolate, 3-8 mm. long, 0.5-2 mm. wide, usually 1.5-3.5 times the length of the branch leaves. 4.
4. Cauline leaves narrowly lanceolate to narrowly ovate-lanceolate, 3-8 mm. long, 1-2 mm. wide; branch leaves 2-4 mm. long, 0.45-0.65 mm. wide; upper perichaetial leaves broadly oval. 8. *Sullivanti*.
 Cauline leaves narrowly lanceolate, 4-7 mm. long, 0.50-0.85 mm. wide; branch leaves 2-3 mm. long, 0.25-0.35 mm. wide; upper perichaetial leaves broadly oval-oblong, slightly narrowed at apex. 8a. *Sullivanti*, var. *microdonta*.

6. FONTINALIS BIFORMIS Sull. Mosses U. S. 54. 1856 (in part, according to Lesquereux & James).

Fontinalis disticha, var., Sull. Musc. Allegh. No. 191. 1845.

Fontinalis disticha, var., Sull. Musc. Allegh. No. 192. 1845.

Pilotrichum sphagnifolium C. Müll. Syn. 2: 150. 1850.

Pilotrichum distichum C. Müll. Syn. 2: 150. 1850 (in part, according to Cardot).

Plants moderately slender, with two forms, appearance varying with age (sometimes considered as changing with seasons), young (vernal) forms yellowish-green, adult (aestival) forms dull green; stems rather flaccid when young, commonly more or less rigid when older, 15-30 cm. long, almost entirely denuded with age, pinnately divided; branches numerous, often fasciculate, elongate, erect-spreading; leaves dimorphic; on young stems (vernal leaves) more or less distant to loosely imbricate, large, soft, concave, usually broadly ovate-lanceolate, some oval-lanceolate to suborbicular, short- to rather long-acuminate, 4-5 mm. long, 2-2.5 mm. wide, occasionally up to 3.5 mm., 1-2.5:1, more or less early disappearing and giving place to adult (aestival) leaves; apices usually obtuse, sometimes subacute or acute, entire to denticulate; median leaf cells linear, obtuse or subobtuse, 11.5-17 μ wide, 3-6:1, sometimes up to 10:1; apical cells broadly rhomboidal, hexagonal-rhombic, more or less sphagniform; alar cells slightly enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, commonly forming small, more or less decurrent auricles; adult leaves (aestival) very different from first leaves, appearing after the disappearance of the majority of the first leaves, rather close, imbricate at ends of branches, firm, erect-spreading, narrowly lanceolate, margins strongly involute to more or less convolute, canaliculate or subtubular, long acuminate, 2-3.5 mm. long, 0.50-0.75 mm. wide, 3-4.5:1; apices acute, entire to denticulate; median leaf cells linear, obtuse or subobtuse, 6.5-12 μ wide, 5-10:1, some up to 15:1; apical cells rhomboidal, hexagonal-rhombic, more or less sphagniform; alar cells slightly enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, commonly forming small more or less decurrent auricles; perichaetium oblong; upper perichaetial leaves suborbicular, truncate and lacerate with age; calyptra long-conical, lacerate at base; capsule immersed to one-half emergent, oval-

oblong or subcylindric, 2 mm. long, 0.75 mm. in diameter; operculum conic-rostrate, 1.25-1.50 mm. long; peristome orange-brownish, teeth long-acuminate to subulate, about 0.75 mm. in length, slightly papillose, sometimes slightly united in pairs at the apex, with 18-20 lamellae; inner peristome imperfect, transverse strands very rudimentary, united only at apex, cilia muricate; spores finely muricate, 10-20 μ in diameter. Type locality, near Columbus, Ohio; collected by Sullivan.

ILLUSTRATIONS:—Sull. Icon. Musc. pls. 59 & 60; Engler & Prantl (Ed. 2) 11: fig. 475; Pl. 75.

EXSICCATI:—Sull. & Lesq. Musci Bor. Am. (Ed. 1) 226b (*f. vernalis*) and 226c (*f. aestivalis*), Ohio; (Ed. 2) 337 (*f. vernalis*) and 338 (*f. aestivalis*), Ohio; Austin, Musc. Appal. 245, Ohio; Sullivan, Musc. Allegh. 191 (*f. vernalis*) and 192 (*f. aestivalis*), Ohio; Lucy Allen, Musci Indianae 12.

In woodland streams, central Ohio and Indiana. Cardot reports that he has seen a specimen which was collected in Wisconsin. In Mosses of Vermont, pp. 36 and 37, March 15, 1898, Grout states that Cardot has written him that he does not know *Fontinalis biformis* from the eastern states.

Fontinalis biformis is distinguished from other Heterophyllae by having its dimorphism shown in young (vernal) leaves and in adult (aestival) leaves rather than in cauline and branch leaves. The sphagniform apical cells aid in quickly recognizing this species when both kinds of leaves are not evident on the same plant; they also help in separating the young leaves of *biformis* from the leaves of *Novae-Angliae*.

7. FONTINALIS DISTICHA Hook. & Wils. in Drumm. Musc. Am. S. States. 151. 1841.

Pilotrimum distichum C. Müll. Syn. 2: 150, 1850, in part, according to Cardot.

Plants slender, more or less delicate, yellowish-green or dull green; stems more or less rigid, up to 15 or 20 cm. in length, blackish or reddish, denuded at base; branches pinnate, distant, more or less distichous, erect-spreading to spreading; leaves dimorphic, distant, cauline 1-1.5 mm. apart, occasionally up to 1.5 mm., erect-spreading, more or less imbricate at ends of stems and branches, more or less firm, moderately concave, narrowly lanceolate, very long and narrowly acuminate, acumen sometimes slightly twisted, 4-5.5 mm. long, about 1 mm. wide, approximately 4-5.5 : 1, usually about 1-1.5 times the length of the branch leaves; apices acute to subobtuse, denticulate to almost entire; branch leaves firm, canaliculate or subultrubular, with margins frequently narrowly involute, narrowly lanceolate, long acuminate, acumen sometimes slightly twisted, 3-4 mm. long, about 0.50 mm. wide, approximately 6.8 : 1; apices usually denticulate or subdenticulate, sometimes entire; median leaf cells linear-attenuate, 6.5-10.5 μ wide, 10-16 : 1, sometimes up to 20 : 1; alar cells moderately enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, sometimes subhexagonal, forming slight auricles or none. According to Sullivan and Lesquereux and James, perichaetium cylindrical; perichaetial leaves truncate and lacerate at apex; capsule narrowly cylindrical and immersed; operculum conical; teeth of peristome papillose, with 12-16 lamellae; inner peristome imperfect, transverse strands of the lower half incomplete and appendiculate.

Type locality, New Orleans, Louisiana; collected by Thomas Drummond.

ILLUSTRATIONS:—Sull., Icones Musc. pl. 63; Pl. 75.

EXSICCATI:—Drumm. Musc. Am. S. States, 151; Sull. Musc. Allegh. 190; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 227, Ala. (Ed. 2) 399 in part; Baker, Alabama Biological Survey, 41, May 26, 1897.

In streams, in Louisiana and Alabama.

Fontinalis disticha is characterized by plants slender and rather delicate, stems more or less rigid, leaves distinctly dimorphic, distant, cauline 1-1.5 mm. apart, some up to 1.5 mm., more or less firm, narrowly lanceolate, very long and narrowly acuminate, approximately 1-1.5 times the length of the branch leaves, alar cells moderately enlarged, forming slight auricles or none.

8. FONTINALIS SULLIVANTI Lindb. Oefv. Finska Vet.-Soc. Förh. 12: 78. 1869.

Fontinalis Lescurii Sull., var. *gracilescens* Sull. Icones Musc. 101. 1864.

Fontinalis Renaaldi Card. Rev. Bryol. 18: 82 and 85. 1891.

Plants very slender, delicate, yellowish or yellowish-green; stems more or less rigid, up to 15 or 20 cm. in length, reddish, denuded at base, pinnately divided; branches distant, distichous, widely spreading; leaves dimorphic, very distant, cauline 1-2 mm. apart, more or less imbricate at ends of stems and branches, erect-spreading, flaccid, more or less concave, narrowly ovate-lanceolate to narrowly lanceolate, long and narrowly acuminate, 3-8 mm. long, 1-2 mm. wide, 3-7 : 1, usually 1.5-3 times the length of the branch leaves; apices acute or subobtuse, commonly denticulate, occasionally subdenticulate, rarely entire; branch leaves flaccid to more or less firm, concave, canaliculate, narrowly lanceolate, acuminate, 2-4 mm. long, 0.45-0.65 mm. wide, 2.5-7 : 1; apices acute to subobtuse, subdenticulate or denticulate; median leaf cells linear attenuate, 6.5-

12 μ wide, 8-15 : 1; alar cells enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, sometimes subhexagonal, *usually forming distinct auricles*; perichaetium narrowly cylindrical; *upper perichaetial leaves broadly oval*, rounded, truncate and lacerate with age; capsule immersed or very slightly emergent, narrowly cylindrical, 2.5-3 mm. long, 0.50-0.65 mm. in diameter; operculum conical and long acuminate; peristome orange-brownish, teeth narrowly lanceolate, acuminate, slightly papillose, 0.50-0.65 mm. long, with 15-23 lamellae; inner peristome imperfect, muricate, transverse strands of lower half incomplete; spores very finely muricate, 18.5-20.5 μ in diameter.

Type locality, Closter, New Jersey; collected by Austin.

ILLUSTRATIONS:—Pl. 74.

EXSICCATI:—Austin, Musc. Appal. 249, N. J., assumed to be duplicate type, in Grout Herb., Herb. of Yale University, and in National Museum of Canada; *Aust.* Musc. Appal. Suppl. I, 524, N. J. & Pa.; *Sull. & Lesq.* Musc. Bor. Am. (Ed. 2) 341; *Huntington*, Grout, N. Am. Musc. Pl. 73, Mass.; *Nichols*, C., Conn.; *Latham*, 54, N. Y.; *Hood*, Grout, N. Am. Musc. Pl. 407, Fla.; *Andrews*, Nov., 1931, Ala.

In stagnant water, attached to bushes, stumps, and roots of trees, in New Jersey, Pennsylvania, Massachusetts, Connecticut, Florida and Alabama. Lesquereux and James cite New Hampshire and Vermont. Cardot states that it has been reported also as occurring in Delaware and Rhode Island. According to Cardot, the *F. Sullivanii* reported from Brattleboro, Vermont, is the *F. Lescurii*, var. *ramosior* of Sullivan instead of the *F. Sullivanii* of Lindberg. According to specimens examined *F. Sullivanii* is collected more frequently in northeastern United States than elsewhere. I have seen two different collections from Florida but both were from the same location.

Fontinalis Sullivanii may be distinguished from *F. disticha* by plants very slender and delicate, cauline leaves very distant, 1-2 mm. apart, flaccid, approximately 1.5-3 times the length of the branch leaves, alar cells enlarged, commonly forming distinct auricles.

Fontinalis Sullivanii forma *viridis* followed by "foliis mollioribus" occurs on a packet of material determined by Cardot. An attempt to locate a description of this form has been unsuccessful. Since the leaves of *F. Sullivanii* are flaccid, I consider these plants as belonging to the species.

8a. Var. MICRODONTA (Ren.) n. comb.

Fontinalis Sullivanii Card. Rev. Bryol. 18: 83 and 85. 1891, not of Lindberg.

Fontinalis microdonta Ren. in litt., according to Cardot.

Some plants flaccid, others more or less rigid, branches very distant, erect or erect-spreading; cauline leaves about 1 mm. apart, erect-spreading, *concave or subconcave at base, plane above, narrowly lanceolate, very long and narrowly acuminate*, 4-7 mm. long, 0.50-0.85 mm. wide, 6.5-10 : 1, apices acute or subacute; *branch leaves flaccid to more or less firm, very concave, very long and narrowly acuminate, subcanaliculate or tubular*, 2-3 mm. long, 0.25-0.35 mm. wide, 5-12 : 1; apices acute, or subacute, occasionally entire; median leaf cells up to 22 : 1; perichaetium cylindrical; *perichaetial leaves broadly oval-oblong, slightly narrowed at apex*, sometimes slightly plicate above; capsule narrowly cylindrical, 2-2.25 mm. long, 0.50 mm. in diameter; operculum conical; peristome sometimes yellowish, teeth narrowly linear-acuminate, about 0.50 mm. long, sometimes united in pairs at the apex; inner peristome very rudimentary, transverse strands incomplete, cilia muricate, appendiculate; spores sometimes almost smooth.

Type locality, unknown; North America.

ILLUSTRATIONS:—Pl. 74.

EXSICCATI:—Without collector, date, locality, or number, herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Lesquereux*, 1883, North America, from Herb. Renauld in Farlow Herbarium.

Cardot places *F. microdonta* in the Malacophyllae. Since the leaves are distinctly dimorphic and resemble so closely those of *F. Sullivanii* Lindb., I am including it in Heterophyllae. Two collections, one sterile and one fruiting, have been available for study. It is quite probable that both are from the same collection. *F. microdonta* and *F. Sullivanii* Lindb. compare so closely in all parts except leaf width and capsule size that there is a strong possibility that the specimen named *microdonta* is a dwarfish form of *Sullivanii* Lindb. However, with very little available material for the determination of constant distinguishing characteristics, it is impossible to make an accurate decision. The cauline and branch leaves of *microdonta* are narrower than those of *Sullivanii* Lindb.; the perichaetial leaves of *microdonta* are broadly oval-oblong and slightly narrowed at apex, while those of *Sullivanii* Lindb. are broadly oval; and the capsule of *microdonta* is smaller, 2-2.25 mm. long and 0.50 mm. in diameter in contrast with a length of 2.5-3 mm. and a diameter of 0.50-0.65 mm. in *Sullivanii* Lindb.

9. FONTINALIS MISSOURICA Card. Rev. Bryol. 23: 69. 1896.

Fontinalis Holzingeri Card. Minn. Bot. Studies 1898, no. VI: 43 and 32: 129. pl. 21. 1903.

Fontinalis Umbachi Card. Minn. Bot. Studies 32: 129. Pl. 22. 1903.

Plants slender, green to yellowish-green, sometimes brownish below; *stems more or less flaccid*, yellowish- or reddish-brown, up to 15-20 cm. in length, more or less denuded at base; branches pinnate, spreading or erect-spreading; *leaves rather indistinctly dimorphic*, distant, subimbricate to loosely imbricate at ends of stems and branches; *cauline leaves more or less flaccid, concave to slightly concave at base and plane above*, occasionally margins narrowly involute, *narrowly or broadly lanceolate, or oblong-lanceolate*, some gradually longly and narrowly acuminate, others gradually shortly and broadly acuminate, 3.5-6 mm. long, few up to 6.5 mm. in length, 1-2 mm. broad, 2.5-6 : 1; apices acute to subobtusate, entire to denticulate; *branch leaves more or less flaccid, usually concave at base, plane at apex or subcanaliculate*, with some margins narrowly involute, *narrowly lanceolate or narrowly oblong-lanceolate*, gradually short- or long-acuminate, 2.50-4 mm. long, 0.5-0.8 mm. wide, 3-6 : 1; apices acute or subobtusate, entire to denticulate; median leaf cells linear-attenuate, 6.5-13.5 μ wide, 8-17 : 1; alar cells moderately enlarged, hyaline to yellowish, or yellowish-brown, rectangular, quadrate, or subhexagonal, frequently forming slight auricles; fruit unknown.

Type locality, near Cole Camp Creek, Benton County, Missouri; collected by the Rev. C. H. Demetrio, July 12, 1894.

ILLUSTRATIONS:—Card. l. c.; Pl. 75.

EXSICCATI:—*Demetrio*, 172, Mo., assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in Farlow Herbarium; 5191 in E. B. Chamberlain Herb., May 29, 1896, Mo.; 3810 in E. B. Chamberlain Herb., Sept. 23, 1907, Mo.; *Holzinger & Elftman*, Mosses of Northern Minnesota International Boundary Trip of 1897, Second Falls of Granite River; *Umbach*, Des Plaines R., Romeo, Ill., June, 1898; 1104, Romeo, Ill.; *Groul*, N. Am. Musc. Pl. 279, Romeo, Ill.; *Morrison & Dawson*, April 15, 1933, Ind.; *Welch*, 1084 Ind.; *Bush*, Plants of Ark. 5414, 5414A; collector unknown, August, 1903, Magnolia, Mass.

In springs, streams, and rivers; collections from Minnesota, Missouri, Illinois, Indiana, Arkansas, and Massachusetts examined.

Fontinalis missourica Card. is characterized by plants slender, stems flaccid or nearly so, leaves rather indistinctly dimorphic, more or less flaccid, cauline leaves slightly concave at base and plane above, broadly lanceolate, oblong-lanceolate, or linear-lanceolate, gradually acuminate, some apices short and broad, others long and narrow, branch leaves smaller, concave at base, subcanaliculate or plane above, narrowly lanceolate or narrowly oblong-lanceolate, gradually short- or long-acuminate.

I have examined the types or duplicate types of *F. missourica*, *F. Holzingeri*, and *F. Umbachi*, but only sterile specimens have been available. With the exception of "younger perichaetial leaves orbicular-ovate, apiculate, apex slightly denticulate" in *F. Holzingeri*, no information concerning the fruits of these plants has been found. With some hesitation, I have placed *F. Holzingeri* and *F. Umbachi* in the synonymy of *F. missourica*, because I have been unable to find any constant, vegetative characteristics by which these three plants may be separated. The study of the fruits will aid in a more satisfactory decision.

I have examined *Fontinalis Nelsoni* Card. sp. nova, Missouri Mosses 1020, collected by N. L. T. Nelson, Irondale, Nov. 5, 1905. I consider the material as belonging to *F. missourica*. Search for the original description has been unsuccessful.

Sect. C. LEPIDOPHYLLAE Card. Mon. Font. 80. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), or exceptionally dimorphic (cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent), firm or nearly so, exceptionally flaccid, more or less concave, ovate-lanceolate, oblong-lanceolate, oval-lanceolate, narrowly lanceolate, sublinear, or rarely broadly ovate. The common range of the members of this section is eastern United States and Canada, although a few have been collected in Ohio, Wisconsin, Missouri, and Saskatchewan.

KEY.

1. Leaves dimorphic, firm or slightly flaccid; older cauline leaves ovate-lanceolate or oblong-lanceolate, usually narrowed into an elongated acumen, 4.5-6 mm. long, 1-2 mm. wide, younger cauline and branch leaves ovate-lanceolate, 3-4.5 mm. long, 1.5-2 mm. wide; apices short, broad, and obtuse. 11f. *Novae-Angliae*, var. *heterophylla*.
 Leaves uniform, older cauline leaves and younger cauline and branch leaves similar with intergradations in shape or size present. 2.
2. Leaves large, ovate-lanceolate, oval-lanceolate, or oblong-lanceolate, 4-7.5 mm. long, 1.5-3 mm. wide, 2-3 : 1. 3.

- Leaves smaller, oblong-lanceolate or ovate-lanceolate to sublinear, 2-6 mm. long, 0.50-2.5 mm. wide, 1.75-4 : 1. 4.
3. Apices frequently subcarinate or carinate; leaves more or less firm, ovate-lanceolate, oval-lanceolate, or oblong-lanceolate, 5-5.5 mm. long, about 2 mm. wide, approximately 2.5 : 1. 12. *Allenii*.
Apices concave; leaves flaccid, more or less broadly ovate-lanceolate, 4-7.5 mm. long, 1.5-3 mm. wide, 2-3 : 1. 11e. *Novae-Angliae*, var. *latifolia*.
4. Leaves narrowly lanceolate or oblong-lanceolate, 2-4 mm. long, 0.5-1.25 mm. wide, 3-3.5 : 1; apices usually more or less acute; plants slender. 5.
Leaves slightly distant, oblong-lanceolate, ovate-lanceolate, or sublinear, 3-7.5 mm. long, 0.5-3 mm. wide, 1.75-4 : 1; apices usually more or less obtuse, some subacute, sometimes more or less cucullate; plants slender to moderately robust. 6.
5. Upper perichaetial leaves usually narrowed at apex, acute, or apiculate. 10. *dalecarlica*.
Upper perichaetial leaves rounded-obtuse. 10a. *dalecarlica*, var. *Macounii*.
6. Leaves oblong-lanceolate or ovate-lanceolate, majority of margins of apices narrowly involute, 3-6 mm. long, 0.75-2.5 mm. wide, 2-4 : 1; apices denticulate to entire, some cucullate. 7.
Leaves sublinear or oblong-lanceolate, majority of margins of apices broadly involute, 3-5 mm. long, 0.50-1.75 mm. wide, approximately 2.5 : 1; apices denticulate, frequently cucullate. 11b. *Novae-Angliae*, var. *involuta*.
7. Leaves approximately 3 mm. long, 1-1.25 mm. wide, 2.5-3 : 1, closely appressed-imbricate; apices denticulate; branches very slender. 11a. *Novae-Angliae*, var. *Lorenziae*.
Leaves 2.5-6 mm. long, 0.75-2.5 mm. wide, 1.75-4 : 1, slightly distant to imbricate; apices entire or denticulate; branches more or less robust. 8.
8. Stems rather flaccid to more or less rigid; branches more or less distant, occasionally fasciculate; leaves more or less firm; apices occasionally cucullate. 9.
Stems very flaccid; branches fasciculate; leaves more or less flaccid; apices rarely cucullate. 11g. *Novae-Angliae*, var. *Grouiti*.
9. Leaves usually ovate-lanceolate, 2.5-6 mm. long, 1-2.5 mm. wide, 1.75-4 : 1; apices usually denticulate, some more or less cucullate; upper perichaetial leaves with apices rounded or subapiculate. 11. *Novae-Angliae*.
Leaves usually oblong-lanceolate, 3-5 mm. long, 0.75-2 mm. wide, 2-4 : 1; apices commonly entire, frequently denticulate; upper perichaetial leaves with apices rounded-obtuse. 10.
10. Apices usually more or less narrowly obtuse; capsule immersed. 11c. *Novae-Angliae*, var. *Delamarei*.
Apices usually more or less broadly rounded-obtuse; capsule approximately one-half emergent. 11d. *Novae-Angliae*, var. *Waghornei*.

10. FONTINALIS DALECARLICA Bryol. Eur. 5: pl. 431. 1846.

Fontinalis squamosa L. Herb., according to Cardot.

Fontinalis squamosa β. *dalecarlica* Hartm. Handb. Skand. Fl. 341. 1849.

Pilotrichum dalecarlicum C. Müll. Syn. 2: 149. 1850.

Fontinalis squamosa, var. *dalecarlica* Husnot, Musc. Gall. 287. 1892.

Plants slender, dull, sometimes glossy at tips of stems and branches, olive-green to dark green or yellowish; stems 10-50 cm. long, more or less rigid, blackish, *denuded at base*; branches numerous, fasciculate, close, slender, elongate, attenuate; leaves more or less imbricate, erect or erect-spreading, narrowly lanceolate or narrowly oblong-lanceolate, more or less long-acuminate, concave, margins usually involute, 2-4 mm. long, 0.5-1.25 mm. wide, 3-3.5 : 1; apices narrowly obtuse or acute, denticulate to entire; median leaf cells linear-attenuate, 6.5-15 μ wide, 10-15 : 1, sometimes up to 20-25 : 1; alar cells enlarged, yellowish or subhyaline, quadrate, rectangular, or subhexagonal, sometimes forming definite auricles; perichaetium oval or oblong; upper perichaetial leaves commonly narrowed at apex, acute or apiculate, lacerate with age; capsule immersed,

oval, oblong, or subcylindric, 2 mm. long, 0.5–1 mm. in diameter; operculum short-conical, obtuse, 0.45–1 mm. long; peristome orange-brownish, sometimes yellow-brownish, teeth linear-acuminate, more or less granulose, 0.3–0.75 mm. long, with 12–22 lamellae; trellis imperfect, very slightly muricate, transverse strands of the lower half incomplete, not appendiculate; spores slightly muricate, majority ranging from 25–35 μ in diameter, mature in summer.

Type locality, Sweden.

ILLUSTRATIONS:—Bryol. Eur. *pl.* 431; Husnot, *Musc. Gall.* *pl.* 80; H. J. Möller, *Arkiv för Botanik* 17: No. 14, *figs.* 10–21; Jennings, *Mosses W. Pa.* *pl.* 30; Grout, *M.H.M.* *pl.* 88 and *fig.* 218; *Pl.* 76.

EXSICCATI:—*Drumm.*, *Musc. Am.* 233; *Sull.*, *Musc. Allegh.* 189; *Aust.*, *Musc. Appal.* 251; *Sull. & Lesq.*, *Musc. Bor. Am.* (Ed. 1) 229; (Ed. 2) 342; *Grout*, *Musci Perfecti* 22, Vt.; *Grout*, *N. Am. Musc. Pl.* 286, Vt. and 286a, Wis.; *E. D. Merrill*, *Flora of Maine*, 67; *G. K. Merrill*, 186, Me.; *Dutton*, *Vermont Flora*, 404; *Welch*, 713, Vt.; *G. E. Nichols*, *Conn.*, in 1907; *Anne Murray Vail*, *N. Y.*, Aug. 1892; *Chapman*, 2064, Va.; *J. K. Small*, *W. Va.*, June 17, 1892; *Mosses of Southern United States*, 32, Ga.; *Sharp*, 33, 133, Tenn.; *Deam*, *Flora of Indiana*, 29527; *Low*, *Canadian Cryptogams*, 53, Labrador; *Macoun*, *Canadian Musci*, 600, N. S.; *Prince*, *Nova Scotia Flora*, 6187.

In streams, Labrador to Georgia, west to Ontario, Tennessee, Indiana, and Wisconsin; Greenland, according to Kindberg. Europe.

Fontinalis dalecarlica is easily recognized by its slender habit, the small, concave, lanceolate, more or less long-acuminate leaves, usually with involute margins, and perichaetial leaves usually narrowed at apex, acute, or apiculate.

I have seen no North American specimen which I believe to be *Fontinalis squamosa* L.

Cardot, in *Mon. Font.* 88, states that he has found in Canadian Musci 231, mixed with *F. Lescurii*, a form analogous to *F. dalecarlica*, var. *gracilescens* Warnst., which he reports as occurring in western Prussia. I have carefully examined Canadian Musci 231, in the Herbarium of Yale University, and I find no plants which satisfy Cardot's description of var. *gracilescens*. Limpricht, in *Die Laubmoose*, vol. 2, p. 671, considers *F. dalecarlica*, var. *gracilescens* Warnst. as a synonym of *F. microphylla* Schimp. I have found no report of the occurrence of *F. microphylla* in North America.

10a. Var. *Macounii* Card. *Rev. Bryol.* 20: 9. 1893, and 23: 70. 1896.

Plants similar to *dalecarlica*; upper perichaetial leaves round-obtuse.

Type locality, Lake Athabasca, Canada; collected by Macoun, 1875.

EXSICCATI:—*Macoun*, *Flora Canadensis*, 755, Lake Athabasca, Sept. 24, 1872; Lake Athabasca, 1879.

I have studied the collections from Lake Athabasca only. The plants of var. *Macounii* examined are more or less flaccid. Cardot separates the variety from *dalecarlica* upon the basis of the round-obtuse perichaetial leaves (acute or apiculate in the species). There were two capsules in the material sent to me by Allorge from the herbarium of the Laboratoire de Cryptogamie, Muséum d'Histoire Naturelle, Paris. I was unable to determine characteristics of perichaetial leaves because they were too old and lacerated. For that reason I have retained Cardot's varietal difference. If, upon examination of a large number of fruits, the upper perichaetial leaves are not consistently round-obtuse but are also acute or apiculate, I should consider *F. dalecarlica*, var. *Macounii* a synonym of *F. dalecarlica*.

II. FONTINALIS NOVAE-ANGLIAE Sull. *Mosses U. S.* 104. 1856.

Fontinalis Howei Aust. ms. in herb., according to Cardot.

Fontinalis Cardoti Ren. in litt., according to Cardot.

Plants slender to slightly robust, dull or glossy, green, to yellowish-green, sometimes more or less brownish; stems rather flaccid to more or less rigid, 15–40 cm. in length, denuded at base, pinnately divided; branches more or less distant, sometimes fasciculate; leaves erect or erect-spreading, slightly distant, subimbricate or imbricate, more or less firm, concave to very concave, usually more or less broadly ovate-lanceolate although frequently oblong-lanceolate, margins more or less narrowly involute, 2.5–4 mm. long, sometimes up to 6 mm. in length, 1–2 mm. wide, sometimes 2.5 mm. in width, 1.75–4 : 1; apices more or less broadly obtuse, subobtuse, or apiculate, usually denticulate, rarely entire, some more or less cucullate; median leaf cells linear-attenuate or linear-rhomboidal, 6.5–12 μ wide, usually 8–15 : 1, rarely up to 20 : 1; alar cells enlarged, subhyaline, yellowish, or brownish, rectangular, quadrate, or subhexagonal, frequently forming distinct auricles; perichaetium oblong or subcylindric; upper perichaetial leaves oval to suborbicular, apices rounded or subapiculate, more or less truncate and lacerate with age; capsule immersed, more or less cylindrical, 2–2.5 mm. long, sometimes 3 mm. in length, 0.5–1 mm. in diameter; operculum conical to conic-acuminate, 0.75–1 mm. long; peristome orange-brownish, teeth linear-acuminate, more or less papillose, 0.50–0.65 mm. long, 13–20 lamellae; trellis imperfect, cilia generally united at apex only, more or less muri-

cate, transverse strands smooth to very slightly muricate, usually incomplete; spores smooth to very finely muricate, 20–22 μ in diameter, mature in summer.

Type locality, New England.

ILLUSTRATIONS:—Sull. *Icones Musc. pl.* 65; Jennings, *Mosses W. Pa. pl.* 30; Grout, M.H.M. *fig.* 217 and *pl.* 88b; *Pl.* 76.

EXSICCATI:—Austin, *Musc. Appal.* 244, 246, N. J., 247, 248 in part, N. J.; Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 225, (Ed. 2) 336; Grout, N. Am. *Musc. Pl.* 272, Mass. and 428 (as *F. Lescurii*) N. Y. City; Welch, 712, Vt.; Pringle, Vt., June 18, 1880; E. D. Merrill, *Flora of Maine*, 70; Huntington, Mass., Feb. 20, 1903; Nichols, Conn. *Mosses*, C₃a; Graves, Conn. *Flora*, 466; Sharp, 34103, Tenn.; Bryophytes of Oklahoma 12; Small, 26, Ga.; Macoun, Canadian *Musci*, sheet 3960 in National Museum of Canada, N. S.; Dupret, *Mousses du Canada*, 118, 123, Quebec.

In streams, Nova Scotia to Georgia, westward to Quebec, Tennessee, and Oklahoma. Jennings reports it also in Newfoundland and Ontario.

Fontinalis Novae-Angliae may be distinguished by leaves concave, usually ovate-lanceolate although frequently oblong-lanceolate, margins more or less narrowly involute, apices commonly more or less broadly obtuse, subobtusate, or apiculate, some more or less cucullate, usually denticulate, and upper perichaetial leaves oval to suborbicular, apices rounded or subapiculate.

I have examined two sterile specimens determined by Cardot as *F. Cardoti*, one collected by Pringle, June 18, 1880, Enosburgh, Vt., and the other collected by Small, July, 1893, Little Stone Mt., Ga., *Mosses of Southern United States* 26. Upon examination of this material and study of Cardot's description, it seems to me that the variations between *Novae-Angliae* and *Cardoti* are sufficiently slight to place *Cardoti* in the synonymy of *Novae-Angliae*.

11a. Var. LORENZIAE Card. *Rhodora* 15: 9. 1913.

Branches very slender, elongated, leaves closely appressed-imbricate, more or less firm, concave, ovate-lanceolate or oblong-lanceolate, small, approximately 3 mm. long, some up to 4 mm. in length, 1–1.25 mm. wide, 2.5–3 : 1; margins frequently narrowly involute; apices usually round-obtusate, some acute, denticulate; fruits unknown.

Type locality, Andover, Conn.; collected by C. A. Weatherby.

ILLUSTRATIONS:—*Pl.* 76.

EXSICCATI:—Weatherby, Andover, Conn., 1907, cotype or duplicate type, in Herbarium of Yale University; Sharp, 88,126, Tenn.; Bryophytes of Highlands, N. C. 107.

This variety has been reported from Connecticut, Tennessee, and North Carolina.

Var. *Lorenziae* is characterized by habit more or less like that of *dalecarlica* and leaves very similar in shape to those of *Novae-Angliae* but smaller. I have retained this plant as a variety of *Novae-Angliae* although it has several characteristics in common with *dalecarlica*, because I have been unable to obtain fruiting material, which would aid in making a more satisfactory decision.

11b. Var. cymbifolia (Aust.) n. comb.

Fontinalis Lescurii Sull., var. ? *cymbifolia* Aust. *Musc. Appal.* 248. 1870.

Fontinalis involuta Ren. & Card., *Card. Rev. Bryol.* 18: 83 & 86. 1891.

Branches frequently compressed; leaves more or less close, subimbricate to imbricate, firm, erect-spreading, sublinear or oblong-lanceolate, concave to very concave, more or less canaliculate, usually margins strongly and more or less broadly involute, 3–5 mm. long, 0.50–1.75 mm. wide, approximately 2.5 : 1; apices short, more or less broad, obtuse or subacute, denticulate, frequently cucullate; median leaf cells 6.5–12 μ wide, 7–16 : 1; alar cells rectangular, quadrate, or subhexagonal, brown, yellowish, or hyaline, sometimes forming distinct auricles; according to Cardot, capsule immersed.

Type locality, New Orleans, Louisiana; collected by Drummond.

ILLUSTRATIONS:—*Pl.* 76.

EXSICCATI:—Austin, *Musc. Appal.* 248, N. J.; Drumm. *Musc. Am.*, S. States, 152; Langlois, Ren. & Card., *Musc. Am. Sept.* 186, La.; Langlois, Grout, N. Am. *Musc. Pl.* 388, La.; Grout, N. Am. *Musc. Pl.* 348, Vt.; Vt., Aug. 1, 1900; Welch, 1086, Ky.; Sharp, 124, Tenn.

In ponds and streams, Vermont and New York to Louisiana and Florida, west to Kentucky and Tennessee.

I consider *involuta* to be a variety of *Novae-Angliae* because of the similarity in the leaf characteristics. I have seen no fruits of *involuta* and Cardot's description of them is very incomplete, but I assume that they are similar to those of *Novae-Angliae*.

11c. Var. *DELAMAREI* (Ren. & Card.) n. comb.

Fontinalis Delamarei Ren. & Card. Rev. Bryol. 15: 71. 1888.

Fontinalis squamosa Delamare, Ren. & Card., Florule de l'île Miquelon 49, 1892.

Plants dull or glossy, olive-green to brownish; branches pinnate and more or less close, often fasciculate; leaves erect or erect-spreading, more or less close, usually subimbricate to imbricate, concave, commonly oblong-lanceolate, sometimes ovate-lanceolate, margins generally narrowly involute, some more or less broadly involute, 3-5 mm. long, 0.75-1.5 or 2 mm. wide, 2.5-4 : 1; apices usually more or less narrowly obtuse, sometimes subacute or acute, commonly subentire or entire although frequently denticulate or subdenticulate; according to Cardot, perichaetial leaves round-obtuse, lacerate with age; capsule and peristome very similar to those of *Novae-Angliae*; spores slightly muricate, 25-28 μ in diameter.

Type locality, Island of Miquelon; collected by Dr. Delamare.

ILLUSTRATIONS:—Bot. Gaz. 14, pl. 144; Pl. 76.

EXSICCATI:—*Delamare*, Ren. & Card., Musc. Am. Sept. 72, Miquelon, assumed to be type or duplicate type, in Grout Herbarium, herbarium of Yale University, and in National Museum of Canada.

In streams of Island of Miquelon.

Variety *Delamarei* is distinguished from *Novae-Angliae* by branches more or less close, leaves subimbricate to imbricate, and commonly oblong-lanceolate, usually narrowly obtuse, with majority of apices entire or slightly denticulate.

11d. Var. *WAGHORNEI* (Card.) n. comb.

Fontinalis Waghornei Card. Rev. Bryol. 23: 71. 1896.

Leaves close, usually oblong-lanceolate, very concave, 3-5 mm. long, 0.75-2 mm. wide, 2-4 : 1; margins of apices more or less narrowly involute, apices usually more or less broadly round-obtuse, subacute, or acute, some more or less cucullate, entire to denticulate; perichaetium oblong to subcylindric; capsule approximately one half emergent, slightly constricted beneath mouth when dry, 2.5-3 mm. long, 0.75-1 mm. in diameter; peristome brownish-orange, teeth frequently united in pairs at apex, densely papillose, approximately 0.75 mm. long, 20-30 lamellae; lattice perfect or almost so, cilia more or less papillose, transverse strands almost smooth or slightly papillose, not appendiculate, more or less complete to base.

Type locality, Heart's Content, Trinity Bay, Newfoundland; collected by the Rev. A. C. Waghorne, March 30, 1892.

ILLUSTRATIONS:—Pl. 76.

EXSICCATI:—*Waghorne*, 42, Nfld., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Waghorne*, Trinity Bay, Newfoundland, 1893, in Herbarium of The New York Botanical Garden.

Without fruit, it is difficult to distinguish between *Novae-Angliae* and var. *Waghornei*. The leaves of *Novae-Angliae* are usually more or less broadly ovate-lanceolate although frequently oblong-lanceolate and the apices are commonly distinctly denticulate; the leaves of *Waghornei* are usually more or less broadly oblong-lanceolate, although some are ovate-lanceolate or oval-lanceolate and the apices are frequently entire. Variety *Delamarei* differs in apices usually more or less narrowly obtuse, commonly sub-entire or entire. Variety *Waghornei* may be separated from var. *involuta* by leaves usually broader, margins more narrowly involute and many apices more or less entire. When in fruit, var. *Waghornei* may be distinguished from other members of *Lepidophyllae* by capsules approximately one half emergent, lamellae commonly more numerous, and trellis perfect or almost so. I have had only one collection for study and, according to Cardot's exsiccati, this is perhaps the only locality from which this plant has been collected.

11e. Var. *LATIFOLIA* Card. Rhodora 15: 9. 1913.

Leaves large, flaccid, more or less broadly ovate-lanceolate, 4-7.5 mm. long, 1.5-3 mm. wide, 2-3 : 1; fruit unknown.

Type locality, Burlington, Conn.; collected by G. E. Nichols, April 16, 1908.

ILLUSTRATIONS:—Pl. 76.

EXSICCATI:—*Nichols*, Cs, Conn., cotype or duplicate type, in herbaria of Yale University and The New York Botanical Garden; *Grout*, N. Am. Musc. Pl. 280, Vt.; Vt., Aug. 27, 1903; *Huntington*, Mass., Mar. 5, 1905; *Blagg*, 9-712, New York; *Steyermark*, Plants of Missouri, 83.

The springs, brooks, and pools, Vermont, Massachusetts, Connecticut, New York, and Missouri.

This variety is distinguished from all other members of *Lepidophyllae* by its large, broadly-ovate, flaccid leaves.

11f. Var. *HETEROPHYLLA* Card. *Rhodora* 15: 9. 1913.

Leaves more or less dimorphic, older cauline leaves and younger cauline and branch leaves unlike, with intergradations in shape or size more or less absent, firm or slightly flaccid; *older cauline leaves* slightly concave or almost plane, ovate-lanceolate or oblong-lanceolate, some margins slightly involute toward apex, 4.5-6 mm. long, 1-2 mm. wide, 2.5-5 : 1; *apices gradually narrowed, elongate*, more or less obtuse, some acute, denticulate; *younger cauline and branch leaves* concave, ovate-lanceolate, 3-4.5 mm. long, 1.5-2 mm. wide, approximately 2 : 1; *apices short and broad*, rounded-obtuse, denticulate, some margins slightly involute toward apex; fruit unknown.

Type locality, North Branford, Conn.; collected by G. E. Nichols, June 11, 1911.

ILLUSTRATIONS:—*Pl.* 76.

EXSICCATI:—*Nichols*, C₃b, Conn., type or duplicate type, in the herbaria of Yale University and The New York Botanical Garden.

In a rocky brook, North Branford, Conn.

This variety differs from *Novae-Angliae* in leaves dimorphic, margins very slightly involute or plane, and apices not cucullate or very rarely so, those of the older cauline leaves more or less long and narrow.

11g. Var. *GROUTI* n. var.

Plantae subgraciles, maxime molles, nitidae, pallide virides aut virides parte superiore, fulvae parte inferiore; caules subtenuis, 15-20 cent. longi, subdenudati aut denudati et nigricantes parte, inferiore pinnati aut bipinnati; rami fasciculati, elongati, usque ad 7 cent. longitudine, erecti aut suberecti; folia distantia, usque ad 1.5 mill., subimbricata aut imbricata ad extremum caulium et ramorum, subflaccida aut flaccida, concava aut subconcava et amplexa ad basim, plurima plana supra, alia subconcava aut late inflexa, ovato-lanceolata aut oblongo-lanceolata, 4-5.5 mill. longa, 1.25-2 mill. lata, 2-3 : 1; apices acuti, subacuti, subobtusiusculi, obtusi, aut late-obtusiusculi, raro cucullati, plerumque denticulati, interdum subdenticulati, interdum integri, frequenter subinflexi; cellulae mediae lineares-rhomboidales aut lineares-attenuatae, 6.5-13.5 micro-mill. latae, 7-15 : 1; cellulae apicales interdum subrhomboidales; cellulae alares magnae, dilatatae, hyalinae, luteolae, aut fulvae oblongae, quadratae, aut subhexagonales, plerumque auriculae bene distinctae; fructus ignotus.

Plants rather slender, very flaccid, glossy, pale green or green above, brownish below; stems slightly delicate, 15-20 cm. long, more or less denuded and blackish at base, pinnately to bipinnately divided; *branches fasciculate, elongate*, up to 7 cm. in length, *erect to erect-spreading*; leaves distant, up to 1.5 mm. apart, subimbricate to imbricate at end of stems and branches, slightly flaccid or flaccid, more or less concave and clasping at base, usually plane above, some slightly concave to broadly involute, *ovate-lanceolate or oblong-lanceolate*, 4-5.5 mm. long, 1.25-2 mm. wide, 2-3 : 1; *apices acute or subacute to rounded-obtuse, very rarely cucullate, usually denticulate*, sometimes subdenticulate, occasionally entire, *frequently narrowly involute*; median leaf cells linear-rhomboidal or linear-attenuate, 6.5-13.5 μ wide, 7-15 : 1; apical cells occasionally more or less rhomboidal; alar cells enlarged, hyaline, yellowish, or brownish, rectangular, quadrate, or subhexagonal, commonly forming distinct auricles; fruit unknown.

Type locality, Fish Pond, New York Fish Hatchery, Cold Spring Harbor, Long Island, New York; collected by A. J. Grout.

EXSICCATI:—Type, in Grout Herbarium; fragment of type in author's herbarium.

F. Novae-Angliae, var. *Grouti* differs from the species in plants very flaccid, branches fasciculate, and leaves more or less flaccid, usually more distant, less concave, and apices rarely cucullate.

12. FONTINALIS ALLENII Card. *Rhodora* 15: 8. 1913. Emend.

Plants more or less robust, glossy, yellowish, golden-yellow, or copper-yellow; stems 15-20 cm. long, more or less rigid, reddish, denuded at base, pinnately divided; branches erect or erect-spreading; *leaves firm*, erect or appressed, subimbricate to imbricate, *ovate-lanceolate, oval-lanceolate, or oblong-lanceolate*, more or less concave, *short and broadly acuminate*, 5-5.5 mm. long, about 2 mm. wide, approximately 2.5 : 1; *apices short and broad, plane, concave, subcarinate, or carinate, rounded-obtuse*, rarely subobtusiusculi or acute, entire to denticulate; median leaf cells linear-attenuate, 6.5-17 μ wide, 10-20 : 1; alar cells usually much enlarged, hyaline to yellowish, quadrate, rectangular, or subhexagonal, commonly forming definite auricles; fruit unknown.

Type locality, Mt. Carmel, Hamden, Connecticut; collected by J. A. Allen, Oct. 22, 1880.

ILLUSTRATIONS:—*Pl.* 76.

EXSICCATI:—Grout, N. Am. Musc. Pl. 395, Conn., duplicate type. (Type is in Cardot's Herbarium, according to G. E. Nichols.)

In a rocky brook, Connecticut.

Only one plant was available for the basis of this description. *F. Allenii* differs from other Lepidophyllae in leaves frequently subcarinate or carinate, margins rarely involute, and the very conspicuous alar cells. Although the apices and alar groups are similar to some in the Tropicophyllae, *F. Allenii* differs in cauline and branch leaves concave, and not keeled at base.

Sect. D. MALACOPHYLLAE Card. Mon. Font. 98. 1892.

Plants more or less flaccid, leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), subconcave or concave at base, plane or slightly concave above, more or less flaccid, commonly distant, up to 1.5 mm. apart, narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, gradually acuminate. Members of this section have been collected throughout the United States and in Canada.

KEY.

- | | |
|---|---|
| 1. Leaves 4-ranked, plane to more or less concave, frequently subcarinate, narrowly lanceolate or oblong-lanceolate, 4-5 mm. long, 1-2 mm. wide. | 21. <i>subcarinata</i> . |
| Leaves 3-ranked, usually plane or subconcave, occasionally concave, not subcarinate. | 2. |
| 2. Leaf bases distinctly clasping the stem, alar cells enlarged, auricles evident, leaves oblong-lanceolate or ovate-lanceolate, more or less long and broadly acuminate. | 3. |
| Leaf bases not distinctly clasping the stem. | 4. |
| 3. Leaves 3.5-7 mm. long, 1-2.5 mm. wide, distant, up to 1.5 mm. apart; apices of perichaetial leaves slightly undulate; lamellae of peristome teeth 20-28. | 17. <i>Lescurii</i> . |
| Leaves 3.5-5 mm. long, 0.75-1.50 mm. wide, rather close, up to 0.75 mm. apart; apices of perichaetial leaves not undulate; lamellae of peristome teeth 15-20. | 17a. <i>Lescurii</i> , var. <i>ramosior</i> . |
| 4. Majority of leaves 3.5-8 mm. long. | 5. |
| Majority of leaves 2.5-3.5 mm. long. | 6. |
| 5. Leaves narrowly lanceolate to lanceolate, 4-8 mm. long, 0.50-1.5 mm. wide, very long and narrowly acuminate, apices frequently abruptly narrowed, auricles distinct. | 18. <i>flaccida</i> . |
| Leaves ovate-lanceolate or oblong-lanceolate, 7-7.5 mm. long, 1.5-2 mm. wide, gradually acuminate, apices more or less broad, short, and truncate, auricles slight to distinct. | 19. <i>denticulata</i> . |
| 6. Leaves 4-5.5 mm. long, 0.65-1.10 mm. wide, apices short and broad, slightly and abruptly narrowed, with margins very frequently slightly involute on one side, usually appearing oblique. | 20. <i>MacMillani</i> . |
| Leaves gradually acuminate, apices not oblique. | 7. |
| 7. Leaves with majority of apices long and narrow. | 8. |
| Leaves with majority of apices short and broad. | 9. |
| 8. Leaves narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, alar cells rather indistinct, auricles usually none. | 13. <i>hypnoides</i> . |
| Leaves narrowly lanceolate, alar cells enlarged, auricles usually distinct. | 15. <i>tenella</i> . |
| 9. Leaves 2.5-4 mm. long, 0.75-1.35 mm. wide, alar cells more or less distinct, slight and distinct auricles frequent. | 14. <i>nitida</i> . |
| Leaves 3-5 mm. long, 1-2.5 (occasionally up to 4) mm. wide, alar cells more or less enlarged, auricles none or very slight. | 16. <i>Duriaei</i> . |

13. FONTINALIS HYPNOIDES Hartm. Skand. Fl. (Ed. 4) 434. 1843.

Fontinalis squamosa L., var. *tenella* Bryol. Eur. 5: pl. 432. 1851-1855.

Pilotrichum Strömbäckii C. Müll. Syn. 2: 150. 1850.

Fontinalis Ravani Hy, Mem. Soc. Agr. Sci. & Arts d'Angers 24: 127. 1882.

Fontinalis hypnoides Hartm., var. *Ravani* Card. Rev. Bryol. 18: 83. 1891.

Plants flaccid, more or less delicate, bright green, pale green, yellowish-green, dull or glossy, sometimes darker below and with age; stems slender, 10-30 cm. long, more or less denuded at base, pinnately divided; branches very distant, erect or erect-spreading, short or elongate; leaves more or less distant, up to 1.5 mm. apart, erect-spreading or spreading, erect-imbricate at ends of stems and branches, flaccid, usually plane, some slightly concave, narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, gradually acuminate, typically the acumen is long and narrow but occasionally short and broad, 3-6 mm. long, 0.75-1.75 mm. wide, 3-5.5 : 1; apices acute, sometimes subacute, usually entire, sometimes denticulate; median leaf cells linear-attenuate or linear-rhomboidal, 8.5-15.5 μ wide, (according to Limpricht, 16-25 μ), 5-12 : 1; alar cells usually more or less enlarged and rather indistinct, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, commonly not forming auricles, rarely slight auricles occur; perichaetium oval or oblong; upper perichaetial leaves more or less broadly oval or suborbicular, rounded-obtuse or subapiculate, truncate and lacerate with age; capsule usually one half emergent, rarely immersed, oval, more or less contracted beneath mouth when dry, 2-2.4 mm. long and approximately 1 mm. in diameter; operculum short-conical; peristome orange-brownish, teeth linear, often united in pairs at the apex, more or less densely papillose, 0.75-0.80 mm. long, with 15-30 lamellae; trellis perfect, very muricate, almost spinulose, transverse strands complete and appendiculate; spores more or less muricate, usually 12-14 μ in diameter, the larger 16-20 μ in diameter (according to Limpricht), ripe in summer.

Type locality, Sweden.

ILLUSTRATIONS:—Bryol. Eur. l. c. H. J. Möller, Arkiv för Botanik 17, No. 14, figs. 32-34; Roth, Eur. Laubm. 2, pl. 30; Husnot, Musc. Gall. pl. 81; Pl. 77.

EXSICCATI:—Leiberg, West American Mosses 137, Idaho; Aven Nelson, Plants of Wyoming 8002; Bryophytes of Wyoming 9671; Baker, Plants of West Central Colorado 631; McIntosh, 1, S. Dak.; Holzinger & Elfman, Mosses of Northern Minnesota, June 20, 1897; Conard (?), 27, Conn.; Macoun, Ont., Oct. 1870; Canadian Mosses 206, Ont.; Canadian Musci 604, Saskatchewan, 206, B. C.; Alberta, Aug. 9, 1904. In sloughs, ponds, streams, rivers, and lakes, United States and Canada. Europe. Asia.

Cardot, (Mon. Font. 100 & 101), states that *F. hypnoides* is a polymorphic species and that both vegetative and fruiting structures show more or less variation. In examining a large number of specimens, I found that a few plants had long-acuminate leaves throughout, that the majority had both long- and short-acuminate leaves, and that the capsules varied from immersed to one-half emergent.

F. hypnoides is characterized by leaves more or less distant, up to 1.5 mm. apart, gradually acuminate, with acumen typically long and narrow but occasionally short and broad, apices commonly entire, sometimes subdenticulate or denticulate, alar cells slightly enlarged, usually more or less indistinct, not forming auricles or very rarely so, and trellis perfect.

14. FONTINALIS NITIDA Lindb. et Arn. Musc. Asiae Bor., Part 2, 161. 1890.

Plants flaccid, delicate, yellowish-green, pale brownish-green, or yellowish-brown, sometimes slightly glossy above and dull below, darkening with age; stems slender, 15-40 cm. long, more or less denuded toward base, pinnately divided; branches distant, elongate, erect-spreading; leaves rather distant, up to 1 mm. apart, erect-spreading, subimbricate toward ends of stems and branches, flaccid, usually plane, occasionally slightly concave, oblong-lanceolate or ovate-lanceolate, gradually acuminate, typically the acumen is short and broad but occasionally long and narrow, 2.5-5 mm. long, 0.75-1.50 mm. wide, 2.5-5 : 1; apices acute or subacute, denticulate to entire; median leaf cells linear-attenuate or linear-rhomboidal, 8.5-15.5 μ wide, 6-15 : 1; alar cells enlarged, more or less distinct, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, frequently forming slight auricles; perichaetium oblong; upper perichaetial leaves oval or suborbicular, rounded or subapiculate, lacerate with age; capsule usually completely immersed, oval, 1.25-1.50 mm. long, 0.75-1 mm. in diameter; operculum short-conical; peristome reddish-orange; teeth linear, often united in pairs at the apex, more or less papillose, 0.65-0.75 mm. long, with 18-25 lamellae; trellis perfect, very muricate, almost spinulose; transverse strands complete and appendiculate; spores finely muricate.

Type locality, Siberia, Asia.

ILLUSTRATIONS:—Pl. 77.

EXSICCATI:—Allen, North American Mosses A3, Ore.; Leiberg, Mosses from Kootenai Co., Idaho; Baker, Colo., Sept. 1, 1896; Pringle, Santa Rita Mts., Ariz., May 6, 1881; Allen, Conn. Mosses C20; Grout, N. Am. Musc. Pl. 297, Quebec (Cardot's type collection for var. *angustiretis*); Macoun, Canadian

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Musci 602, B. C., 604a, 759b, Ont.; Flora Canadensis 2615, B. C.; Brinkman, Bryophytes of S. and Cen. B. C., Canada 145.

In brooks, rivers, and lakes, United States and Canada. Asia.

Cardot, (Mon. Font. 104), states that *F. nitida* is only a regional race of *F. hypnoides*, and that they differ in very slight characters. It is frequently difficult to distinguish between the two species by means of one point of contrast. *F. nitida* usually has approximately the following combination of characteristics: commonly leaves smaller, less distant, apices more or less broad and short, frequently denticulate or subdenticulate, alar cells rather distinct, frequently forming slight auricles, and trellis perfect.

I have been unsuccessful in locating any description of the variety *angustiretis* Card. in litt., but I have examined several packets of sterile material belonging to the type collection and others determined by Cardot. I have concluded, without the aid of the original description, that *angustiretis* is not sufficiently different from the species to be worthy of varietal rank, and have combined the exsiccata of the species and variety.

15. FONTINALIS TENELLA Card. Rev. Bryol. 18: 83 & 85. 1891.

Plants very flaccid and delicate, yellowish or pale yellowish-green; *stems very slender*, 10–20 cm. long, more or less denuded at base, pinnately divided; branches elongate, rarely producing secondary branches; leaves up to 1 mm. apart, erect-spreading, *flaccid, usually plane*, some slightly concave, *narrowly lanceolate, very longly and gradually acuminate*, 2.5–5.5 mm. in length, 0.45–1.5 mm. wide, 3.5–6 : 1; *apices acute*, entire to denticulate; median leaf cells linear-attenuate or linear-rhomboidal, 6.5–12 μ wide, 7–16 : 1, (10–20 : 1, according to Cardot); *alar cells enlarged*, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, *frequently forming slight, distinct auricles*; perichaetium oblong; upper perichaetial leaves oval or suborbicular, apices rounded, frequently apiculate, lacerate with age; *capsule immersed, oval or oblong*, 1.25–2 mm. long, 0.50–1 mm. in diameter; operculum short-conical; peristome orange-brownish or yellowish-brown, linear, often united in pairs at the apex, strongly papillose, 0.50–0.65 mm. long, with 15–20 lamellae; *trellis imperfect*, strongly muricate, *lower transverse strands incomplete*; spores finely muricate, 11.5–15.5 μ in diameter.

Type locality, Lake Pend d'Oreille, Idaho; collected by Leiberg.

ILLUSTRATIONS:—Pl. 77.

EXSICCATI:—Leiberg, N. Am. Mosses 137, Idaho, assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in Herb. of The New York Botanical Garden; Macoun, Canadian Musci 207, B. C.; Brinkman, Bryophytes of S. and Cen. B. C. 247.

An accurate range of distribution is impossible with material available from two localities only. According to the specimens examined, this species occurs in western United States and Canada.

F. tenella differs from *F. hypnoides* in leaves smaller, narrowly lanceolate, very long acuminate, alar cells enlarged, frequently forming slight but distinct auricles, and trellis imperfect.

16. FONTINALIS DURIÆI Schimp. Syn. (Ed. 2) 555. 1876.

Fontinalis hypnoides Hartm., var. *Duriæi* Husnot, Muscol. Gall. 287. 1892.

Fontinalis obscura Card. Minn. Bot. Studies 3²: 120. pl. 22. 1903.

Plants flaccid, green, pale-green, olive-green, or yellowish-green, sometimes brownish, often blackish at base; stems slender, 10–30 cm. long, foliated to base or denuded, pinnately divided; branches distant, numerous, unequal in length, erect to spreading; leaves more or less distant, 0.5–1.5 mm. apart, occasionally subimbricate, imbricate at ends of branches, spreading or erect-spreading, flaccid to more or less firm, plane to subconcave, sometimes with slight longitudinal folds, (margins on one side occasionally slightly reflexed, according to Limpricht), *oblong-lanceolate to more or less broadly ovate-lanceolate*, occasionally subovate, *short and broadly acuminate*, 3–5 mm. long, rarely cauline leaves up to 7 mm. in length, 1–2.5 mm. wide (up to 4 mm. in width, according to Limpricht), 2–5.5 : 1; apices acute to subobtusate, denticulate to entire; median leaf cells linear-attenuate or linear-rhombic, 8.5–17 μ wide, 6–18 : 1; *alar cells more or less enlarged*, hyaline to yellowish-brown, rectangular, subquadrate, quadrate, or subhexagonal, *auricles none or very slight*; perichaetium oblong; upper perichaetial leaves oval-suborbicular, broadly rounded at apex or apiculate, lacerate with age; *capsules immersed, oval or short oblong*, not contracted beneath mouth when dry, approximately 2 mm. long, 1–1.25 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear, papillose, 0.75–0.90 mm. long, frequently united in pairs at the apex, with 15–35 lamellae; *trellis perfect*, muricate, transverse strands complete, lower ones appendiculate; spores finely muricate or smooth, 15–20 μ in diameter; ripe in summer.

Type locality, LaCalle, Algeria, Africa; collected by Durieu in 1840.

ILLUSTRATIONS:—Husnot, Muscol. Gall. *pl.* 81; Roth, Eur. Laubm. 2: *pl.* 30; *Pl.* 77.

EXSICCATI:—*Ren. & Card.*, Musc. Am. Sept. Exsicc. Sept. 382, 383, Minn.; *Grout*, N. Am. Musc. *Pl.* 190, Minn., 404, N. Dak.; *Holzinger*, Mosses of North-eastern Minn., July 28, 1902; *Williams*, 82, Mont.; *Jones*, Utah, July 12, 1886; *Pringle*, Santa Rita Mts., Ariz., May 6, 1887; *Bolander*, 79, Cal.; *Bush*, Eagle Rock, Mo., June 17, 1897; *Deam*, Flora of Indiana 49117; *Nichols*, Mich., Aug., 1926; *C₄*, *C₆^a*, *C₆^b*, Conn.; *Lawson*, Canadian Musci 995; *MacFadden*, 730, B. C.

In streams and falls, and occasionally in swamps, in United States and Canada. Europe. Africa. It is possible that an error has been made in considering *F. obscura* as a synonym of *F. Duriaei*, because the plants of *F. obscura* examined were sterile and from two localities only. However, I was unable after making a thorough study, to discover any constant distinguishing characteristics. *F. Duriaei* is a variable species and it seems that some of the smaller forms with closer and narrower leaves were named *F. obscura*. Cardot states that the plants of *F. obscura* are dark green or blackish and that the leaves are fragile or brittle. I believe this is due to a deposit of unknown nature which covers the older leaves. The younger leaves are yellowish-green.

F. Duriaei resembles *F. hypnoides* but it can be recognized by plants generally more robust, leaves usually broader, short and broadly acuminate, apices acute to subobtuse, entire to denticulate, alar cells more or less distinct, capsules immersed, and not contracted beneath mouth when dry.

On packets of material determined by Cardot, I have found the names *F. Duriaei*, forma *latifolia* and forma *integrifolia*. After a very careful search for the descriptions, nothing has been found concerning these forms.

17. FONTINALIS LESCURI Sull. Mosses U. S. 1856.

Plants flaccid, golden to green; stems slender, up to 40 cm. in length, denuded and usually darker at base, irregularly pinnately divided; branches more or less numerous, distant, slender, commonly elongate; leaves distant, up to 1.5 mm. apart, erect-spreading or loosely imbricate, flaccid, clasping and more or less concave at base, commonly plane above, frequently slightly concave, oblong-lanceolate or ovate-lanceolate, more or less longly and broadly acuminate, 3.5–7 mm. long, 1–2.5 mm. wide, 2.5–3.5 : 1; apices usually acute, occasionally subobtuse, denticulate or subdenticulate; median leaf cells linear or linear-rhombic, 8.5–12 μ wide, 10–15 : 1; alar cells enlarged, hyaline to yellowish or brownish, rectangular, quadrate, or subhexagonal, commonly forming distinct auricles. According to Cardot and Sullivant, perichaetium subcylindric; upper perichaetial leaves broadly oval, tubulose, enfolding capsule, apices slightly undulate, rounded-obtuse, truncate and lacerate with age; capsule immersed, subcylindric, not contracted beneath mouth when dry, 2–2.5 mm. long, 0.65 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear-acuminate, subulate, papillose, 0.75–1 mm. long, with 20–28 lamellae; trellis imperfect, slightly muricate, cilia united at apex only, free at base appendiculate; spores about 20 μ in diameter, mature in summer.

Type locality, Falls of Little River, Lookout Mountain, Alabama; collected by Lesquereux.

ILLUSTRATIONS:—Sull., Icones Musc. *pl.* 61; Grout, M.H.M. *pl.* 87; *Pl.* 78.

EXSICCATI:—*Sull. & Lesq.*, Musc. Bor. Am. (Ed. 1) 228, (Ed. 2) 340 in part; *Pringle*, Vt., June 19, 1880; *Grout*, near Plymouth, N. H., Oct. 4, 1897; *Conard*, 237, N. Y.; *Nichols*, Conn., April 14, 1911; *Naylor*, near Greencastle, Ind., Aug., 1906; *Sharp*, Bryophytes of Highlands, N. C., 108; *Meeker*, Kans., in 1900; *Macoun*, N. S., sheet no. 3958 in National Museum of Canada.

In streams, Nova Scotia to Alabama and west to the Rocky Mountains. It has been reported as occurring in Oregon but I have seen no specimens collected west of Kansas.

F. Lescurii is a very difficult moss to determine. It is frequently confused with *F. dalecarlica*, *F. Novae-Angliae*, *F. hypnoides*, and *F. tenella*. *F. Lescurii* is characterized by plants flaccid, leaves more or less distant, flaccid, clasping and more or less concave at base, plane or slightly concave at apex, oblong-lanceolate or ovate-lanceolate, more or less long and broadly acuminate, apices usually acute, occasionally subobtuse, denticulate or subdenticulate, and auricles generally distinct.

17a. FONTINALIS LESCURI Sull., var. RAMOSIOR Sull. Icones Musc. 101. 1864.

Fontinalis Frostii Sull. in litt., according to Cardot.

Fontinalis Eatonii Sull. in Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 224c. 1856.

Fontinalis Sullivantii Lesq. & James, Man., 271, 1884, not Lindb.

Plants more slender than the species; branches more elongate; leaves closer, commonly 0.50–0.75 mm. apart, narrower, 3–5.5 mm. long, 0.75–1.50 mm. wide, 3–4.5 : 1; perichaetial leaves shorter, 2–2.5 mm. long, very concave, not undulate at apex; capsule 2–3 mm. long, 0.75–1 mm. in diameter, operculum about 1 mm. in length; teeth of peristome slightly shorter, approximately 0.65 mm. in length, with less numerous and more distant lamellae, commonly 15–20; spores 15–20 μ in diameter.

Type locality, Cheshire Co., New Hampshire; collected by Frost and Eaton, 1858.

ILLUSTRATIONS:—Sull., *Icones Musc. pl. 62; Pl. 78.*

EXSICCATI:—C. C. Frost, near Brattleboro, Vt., 1858, ex herb. D. C. Eaton, in herb. of the New York Botanical Garden, assumed to be a duplicate of the type.

If it were not for the difference in the perichaetial leaves and the peristome, I should consider the specimens examined as *F. Lescurii* because *F. Lescurii* is a species which shows great variation. Without fruit it is difficult to distinguish between *F. Lescurii* and var. *ramosior* because the plants of the variety can be considered as small forms of the species.

According to Cardot, the two localities frequently given for the type are one because the collectors located the collection from different points, one giving Cheshire Co., New Hampshire, and the other near Brattleboro, Vermont. Brattleboro is on the west side of the Connecticut River which separates Vermont and New Hampshire.

Students of Fontinalaceae have placed *F. Eatonii* Sull. in the synonymy of *F. antipyretica* L., var. *gigantea* Sull. and *F. Novae-Angliae* Sull. The leaves are not keeled-conduplicate. Therefore, it can not be considered correctly as a synonym of species or varieties in Tropidophyllae. I have had very small portions of the plant for study. However, the fragments examined have been from Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 224c, 1856, collected by D. C. Eaton in Cheshire Co., New Hampshire. The leaf apices from one branch resemble those of *F. Novae-Angliae* and those from another branch resemble the apices of *F. Lescurii*. The form, size, distance, apices, bases, auricles, and areolation of many leaves compare rather closely with those of *F. Lescurii*, var. *ramosior*. For these reasons, in the absence of capsules and complete specimens for study, I consider *F. Eatonii* Sull. as a synonym of *F. Lescurii* Sull. var. *ramosior* Sull. It is quite possible that, instead, it should be placed in the synonymy of *F. Lescurii*, but more material for study is needed to make a final decision.

18. FONTINALIS FLACCIDA Ren. & Card. Bot. Gaz. 13: 201. 1888.

Plants flaccid, some slightly rigid, *delicate*, yellowish or yellowish-green; *stems slender*, up to 40 cm. in length, blackish and denuded at base, pinnately divided; branches very distant, erect-spreading, slender; *leaves very distant*, up to 1.5 mm. apart, imbricate at end of branches, spreading or erect-spreading, *very flaccid, subconcave to concave at base, plane or very slightly concave at apex, narrowly lanceolate to lanceolate, very long and narrowly acuminate*, 4–8 mm. long, 0.50–1.50 mm. wide, 3–6 : 1; *apices very frequently abruptly narrowed, obtuse to truncate*, occasionally acute, *denticulate*, sometimes almost entire; median leaf cells linear-attenuate, 8.5–10 μ wide, 10–15 : 1, occasionally up to 20 : 1; *alar cells large to very large*, hyaline to yellowish or brownish, rectangular or subhexagonal, *forming distinct auricles*. According to Cardot, perichaetium subcylindric; upper perichaetial leaves broadly oval, truncate and lacerate with age; *capsule immersed, subcylindric*, not contracted beneath mouth when dry, 2 mm. long, 0.50 mm. in diameter; operculum conical; peristome orange-brownish, teeth narrowly linear-acuminate, often united in pairs at apex, slightly papillose, 0.65–0.75 mm. in length, with 18–20 lamellae; *trellis imperfect*, muricate; spores very finely muricate or almost smooth.

Type locality, Bayou Bonfouca, Louisiana; collected by the Rev. A. B. Langlois, March 24, 1886.

ILLUSTRATIONS:—Bot. Gaz. 13: *pl. 19; Pl. 78.*

EXSICCATI:—Langlois, Flora Louisiana 140, type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in United States National Herbarium; Sull. & Lesq., Musc. Bor. Am. (Ed. 2) 340 in part, according to Cardot; Nichols, Connecticut Mosses, C₂.

In stagnant or running water in Louisiana and Connecticut; according to Cardot, also in Alabama and New Hampshire. Nichols, in Rhodora 15: 10, 1913, reports it, in addition, in Massachusetts, Maryland, Georgia, Ohio, Missouri, and British Columbia.

Fontinalis flaccida is distinguished from other species of Malacophyllae by its very flaccid, narrowly lanceolate, very long and narrowly acuminate leaves, with apices very frequently abruptly narrowed, obtuse, subobtuse, or truncate, occasionally acute, commonly denticulate, and alar cells large and rectangular to subhexagonal.

A careful search for the original description of *F. flaccida* forma *minor* which appears on a packet of material determined by Cardot was unsuccessful. It does not differ materially from the type.

19. FONTINALIS DENTICULATA Kindb. Hedwigia 36: 61. 1897.

Plants very flaccid, yellowish or yellowish-green; stems at least 10 cm. long, denuded at base, pinnately divided; *leaves distant*, subimbricate to imbricate at ends of stems or branches, erect or erect-spreading, *flaccid, plane, ovate-lanceolate or oblong-lanceolate, gradually narrowed toward more or less blunt apex*, 7–7.5 mm. long, 1.5–2 mm. wide, 3.5–4.5 : 1; *apices short, more or less broad, sub-obtuse to more or less truncate, denticulate*; median leaf cells linear-attenuate, 6.5–10 μ wide, 8–16 : 1, occasionally 20 : 1; *alar cells commonly enlarged*, hyaline subhyaline, or yellowish, rectangular to subhexagonal, *auricles slight to distinct*; fruit unknown.

Type locality, near St. Louis, Missouri; collected by Dr. Engelman, in 1889 or 1891.

ILLUSTRATIONS:—*Pl. 77.*

EXSICCATI:—Specimen assumed to be duplicate type, determined by Röll, ex herb. Berlin, in herb. of New York Botanical Garden.

A very small amount of sterile material was available for study. The length given in the description is that of the material studied. Kindberg gives no length in his description. The leaves of *F. denticulata* resemble those of *F. flaccida*. It is impossible to determine definitely whether or not there is any relationship between the two plants with the material at hand. *F. denticulata* is characterized by long, flaccid, plane, ovate-lanceolate or oblong-lanceolate leaves which are gradually narrowed toward the short, broad, more or less truncate or obtuse, denticulate apices.

20. FONTINALIS MACMILLANI Card. Rev. Bryol. 23: 71. 1896.

Plants more or less flaccid, dull green or yellowish-green; stems about 10 cm. long, slightly denuded at base, irregularly pinnately divided; leaves slightly distant, flaccid or more or less firm, erect-spreading, slightly imbricate to imbricate at end of branches and stems, concave at base, plane or more or less concave above, *narrowly lanceolate, or oblong-lanceolate, shortly and broadly acuminate, slightly and abruptly narrowed near the point*, 4–5.5 mm. long, 0.65–1.10 mm. wide, 3.5–6 : 1; *apices acute or subacute, denticulate or subdenticulate, frequently more or less twisted, margins usually slightly involute on one side, causing apices to have an oblique appearance*, median leaf cells linear-attenuate, 8.5–12 μ wide, 12–16 : 1; alar cells more or less enlarged, hyaline, subhyaline, or yellowish, rectangular, quadrate, or subhexagonal, auricles slight or none; fruit unknown.

Type locality, northern Minnesota, near International Boundary; collected by Prof. Conway MacMillan, 1895.

ILLUSTRATIONS:—*Pl. 79.*

EXSICCATI:—*MacMillan*, Mosses of Minnesota, Sept., 1895, type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris.

It is impossible to determine a definite relationship between *F. MacMillani* and other species in Heterophyllae and Lepidophyllae because the material obtainable for study was sterile and small in amount; difficulties were increased because the leaves were covered with "Coconéidées" (according to Cardot), and the apices had been partially destroyed by some parasite. The more or less concave and firm leaves are characteristic of the Lepidophyllae, but the leaf shape, alar groups, bases, and apices resemble those of Malacophyllae. Since the plants resemble those of the latter group and since Cardot, with type material at hand, placed *MacMillani* in the Malacophyllae, I am continuing this classification of the species. *F. MacMillani* is characterized by leaves narrowly lanceolate or oblong-lanceolate, short and broadly acuminate, slightly and abruptly narrowed near the point, and apices more or less acute and denticulate, frequently more or less twisted, and margins usually slightly involute on one side.

21. FONTINALIS SUBCARINATA Card. Bot. Gaz. 37: 376. 1904.

Plants flaccid, yellowish, yellowish-green, or dull-green; stems 15–20 cm. long, denuded below, pinnately divided; branches elongate, more or less erect; *leaves rather distant*, approximately 1 mm. apart, erect or slightly erect-spreading, *4-ranked, flaccid, plane to more or less concave, frequently longitudinally sulcate in the middle, narrowly lanceolate or oblong-lanceolate, long acuminate*, 4–5 mm. long, 1–2 mm. wide, 2.5–5 : 1; *apices acute*, occasionally subacute, *entire*, some subdenticulate or denticulate; median leaf cells linear-attenuate, 8.5–13.5 μ wide, 10–15 : 1; *alar cells slightly enlarged, frequently rather indistinct*, subhyaline, yellowish, or yellowish-brown, rectangular, subquadrate, subrounded, or subhexagonal, *auricles usually none or rarely very slight*; fruit unknown.

Type locality, Cypress Hills along Battle Creek, Assiniboia, Canada; collected by Macoun, 1895.

ILLUSTRATIONS:—Bot. Gaz. 37: pl. 23–26; *Pl. 79.*

EXSICCATI:—*Macoun*, 264, assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, Canadian Cryptogams, sheet 4389 in National Museum of Canada.

The specimens studied were collected in Saskatchewan, Canada.

F. subcarinata is characterized by the flaccid, plane or slightly concave, narrowly lanceolate or oblong-lanceolate leaves, frequently subcarinate or sulcate, apices usually acute and entire, alar cells slightly enlarged, more or less indistinct, and auricles usually none or rarely very slight.

Sect. E. STENOPHYLLAE Card. Mon. Font. 122. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), rather firm, narrowly lanceolate, long linear-acuminate, and more or less canaliculate. The only specimen reported for this section was collected in Minnesota.

22. FONTINALIS DICHELYMOIDES Lindb. Öfvers. Finska Vet.-Soc. Förhandl. 12: 76. 1869.

Plants more or less flaccid, slightly glossy, yellowish above, dull brown below; stems slender, 6–20 cm. in length, not denuded at base or only slightly so, more or less regularly pinnately divided; branches distant, erect-spreading, more or less elongate, 5–15 mm. long, slightly attenuate, often curved at the ends; leaves more or less distant, approximately 1 mm. apart, erect-spreading or secund, firm, narrowly lanceolate, margins involute, canaliculate, long-acuminate, 3–4.5 mm. long, 0.35–0.60 mm. wide, occasionally up to 1 mm. wide, 4.5–5 : 1; apices commonly acute, also subacute to obtuse, typically entire, sometimes subdenticulate; median leaf cells linear-attenuate, 8.5–10 μ wide, 10–30 : 1; alar cells enlarged, hyaline to yellowish or brownish, rectangular, subrectangular, or subhexagonal, auricles commonly very apparent and slightly convex; fruit unknown or incompletely known.

Type locality, Lake Piojärvi, Finland; collected by Brotherus, Aug. 7, 1869.

ILLUSTRATIONS:—Roth, Eur. Laubm. 2: pl. 31; Engler and Prantl (Ed. 2) 11: fig. 476; H. J. Möller, Arkiv för Botanik 17: no. 14, figs. 26–28 and pl. 8, no. 15; Pl. 79.

EXSICCATI:—Brotherus, Lake Piojärvi, Finland, Aug. 7, 1869, from Herb. S. O. Lindberg, assumed to be type or duplicate type, in Herb. of New York Botanical Garden; Arthur, Vermilion Lake, Minn., July 21, 1886.

In Lake Vermilion, Minn., according to only material available. Also in Europe.

Only a small amount of the material from Vermilion Lake has been available. It compares favorably with the Brotherus specimens cited, with the exception that the Minnesota plant is slightly more robust and less flaccid, the leaves are more or less subimbricate, about 0.5 mm. apart, and more firm. It seems that the *Fontinalis* from Lake Vermilion resembles the Piojärvi specimen sufficiently to be considered as *F. dichelymoides*. Limpricht, Möller, and Cardot state in their descriptions that the fruit is unknown. However, Cardot mentions in his notes that the perichaetial leaves are broadly oval, rounded or truncate, and slightly lacerate at apex or short-apiculate.

Sect. F. SOLENOPHYLLAE Card. Mon. Font. 124. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), more or less firm when moist, narrowly lanceolate, very concave, subtubulose, or tubulose. The common range of the members of this section is southern and south-central United States.

KEY.

Plants very slender, very delicate, stems slender to filiform, 10–20 cm. in length, leaves up to 2 mm. apart, long-acuminate, almost subulate, convolute-tubulose, and apices acute. 23. *filiformis*.

Plants slender, delicate, stems slender, 4–10 cm. in length, leaves up to 1 mm. apart, rarely long and narrowly acuminate, more or less tubulose, and apices commonly more or less obtuse. 24. *Langloisii*.

23. FONTINALIS FILIFORMIS Sull. & Lesq. in Lesq. & James, Mosses of North America 271. 1884.

Fontinalis disticha Hook. & Wils., var. *tenuior* Sull. Icones Musc. 103. 1864.

Fontinalis filiformis Sull. & Lesq., var. *tenuifolia* Card. Mon. Font. 126. 1892.

Plants very slender, very delicate, yellowish or yellowish-green; stems more or less rigid, slender to filiform, 10–20 cm. long, denuded and blackish at base, pinnately divided; branches distant, distichous, erect-spreading, filiform, and plumose; leaves very distant, up to 2 mm. apart, erect or erect-spreading, firm when wet, narrowly lanceolate, long-acuminate, almost subulate, convolute-tubulose, 3–6 mm. long, 0.35–0.50 mm. or more wide (unrolled), about 8–10 : 1; apices acute, subdenticulate or denticulate; median leaf cells linear-rhombic, 6.5–12 μ wide, 6–15 : 1; alar cells slightly enlarged, hyaline, subhyaline, or yellowish, rectangular or subhexagonal, usually forming distinct auricles; perichaetium narrowly cylindric; perichaetial leaves oval-oblong, rounded or subapiculate, lacerate with age; capsule narrowly cylindric, immersed, 2.5 mm. long, 0.35–0.50 mm. wide; operculum conic-acuminate; peristome orange-brownish, lanceolate-subulate, papillose, approximately 0.60 mm. in length, with 17–28 lamellae; cilia rudimentary, short, up to 0.40 mm. in length, appendiculate, some connected by a few, smooth, transverse strands.

Type locality, Southern Kentucky; collected by Lesquereux.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 64: Pl. 79.

EXSICCATI:—Sull. & Lesq., Musc. Bor. Am. (Ed. 2) 339 in part; Austin, Musc. Appal. 250; Ren. &

Card., Musc. Am. Sept. Exsicc. 230, La.; *Lesquereux*, southern Ky., ex herb. C. F. Austin; *Demetrio*, 7, Mo.; *Langlois*, near St. Martinsville, La. 1892; Bois Lobbé, La., Aug. 6, 1892, March 14, 1893; La., March 15, 1898; Flora Ludoviciana 746.

In stagnant water, southern United States.

Fontinalis filiformis is the most delicate species in the genus. It is further characterized by leaves firm when wet, narrowly lanceolate, long-acuminate, convolute-tubulose, apices acute, and capsule narrowly cylindric.

I can find no apparent difference between sterile and fruiting plants of the var. *tenuifolia* and the species. Several specimens, including duplicates of the type, were examined and leaves were firm when wet instead of very flaccid as described by Cardot. The leaf ranges in size recorded for the variety also occur in the species. No outstanding difference in size between plants of the species and the variety were found.

24. FONTINALIS LANGLOISII Card. Rev. Bryol. 84 & 86. 1891.

Plants slender, delicate, more or less rigid, yellowish or yellowish-green above, dull green or darker green below; stems slender, short, 4-10 cm. long, denuded and blackish below, pinnately or bipinnately divided; branches distant, distichous, slender, delicate, plumose, erect-spreading; leaves about 1 mm. apart, firm when moist, erect-spreading to subimbricate, narrowly lanceolate, more or less tubulose, 3-3.5 mm. long, occasionally 4-5 mm. in length, 0.45-0.65 mm. wide, occasionally 0.75 mm. in width, 6:1; apices typically obtuse or subobtuse, some subacute, rarely acute, frequently slightly cucullate, entire to denticulate; median leaf cells linear-rhombic, 6.5-13.5 μ wide, 9-16:1; alar cells slightly enlarged, hyaline to yellowish, rectangular, quadrate, or subhexagonal, auricles slight or none; perichaetium cylindric; perichaetial leaves lacerate with age; capsule cylindric, 1.75-2 mm. long, approximately 0.5 mm. in diameter; smooth, 18.5-24 μ in diameter.

Type locality, Ravine-aux-Cannes, near Mandeville, La.; collected by the Rev. A. B. Langlois, Oct. 1, 1890.

ILLUSTRATIONS:—Pl. 79.

EXSICCATI:—*Rev. & Card.*, Musc. Am. Sept. Ex. 229, 231, La.; *Grout*, N. Am. Musc. Pl. 387, La.; *Langlois*, Flora Ludoviciana 648; 518, 814, 816^a, La.; *Cellestin*, 816, La.

In ponds, ravines, and bayous, in Louisiana.

Fontinalis Langloisii is quickly recognized by plants short, slender, delicate, branches pinnate, leaves narrowly lanceolate, more or less tubulose, apices usually more or less obtuse and denticulate, and frequently slightly cucullate.

No description of the fruit was found. Upon one plant, N. Am. Musc. Pl. 387, I found old capsules which served as the basis for my incomplete description of the fruit.

Fontinalis involuta R. & C., forma *angustifolia* (Cardot?) occurs on two collections made by Langlois, Oct. 6, 1891, Abita, La., numbers 745 & 745b. The search for a description of this form was unsuccessful. "Folius angustioribus.—(4-5 mm. long, $\frac{1}{2}$ - $\frac{3}{4}$ mm. lates) longius acuminatis, subacutis" is written on the packet, no. 745, which was sent to me from Paris by Allorge. I have examined the material carefully and have concluded that probably the plants should be considered as *F. Langloisii*.

2. BRACHELYMA Sch. Syn. (Ed. 2) 557. 1876.

Fontinalis sp. P. B. Prodr. 58. 1805.

Dichelyma sp. Myr. in Act. Reg. Acad. Scient. Holm. 274. 1832.

Cryphaea sp. Nees in Pflanz. Maxim. von Wied, Reise Nord-Amerika 2: 27. 1841.

Neckera Sect. 9, *Dichelyma* Subsect. 2, *Cryphaeadelphus* C. Müll. Syn. 2: 145. 1851.

Cryphaeadelphus (C. Müll.) Card. in Rev. Bryol. 31: 6. 1904.

Plants submerged and floating, slender to more or less robust; stems slender, denuded at the base; leaves tristichous, costate, oblong-lanceolate, carinate-conduplicate, apices acute or obtuse, denticulate to subentire; median leaf cells hexagonal-rhombic or linear-attenuate; alar cells rectangular, auricles not distinct; perichaetium oblong; perichaetial leaves imbricate, ecostate, concave, lanceolate, acuminate, entire; capsule very shortly pedicellate, completely immersed; operculum rostrate; calyptra split along one side, small, covering only the operculum; peristome double, teeth linear, with few lamellae, erect, cilia longer than the teeth, nodulose or appendiculate, free or united at the apex by transverse strands; spores yellowish, almost smooth.

The plants of this genus resemble those of *Fontinalis* in leaf forms and capsules immersed, and those of *Dichelyma* in leaves costate, calyptra split along one side, and in outer peristome structure. *Brachelyma* has been reported from the United States only.

KEY.

- Plants usually slender and more or less flaccid; stems pinnately branched; leaf apices acute to subobtusate; interior cells rather short hexagonal-rhombic, 2-4 : 1, sometimes 6-7 : 1. 1. *subulatum*.
 Plants usually robust and rigid; stems pinnately or bipinnately branched; leaf apices subobtusate to obtuse; interior cells linear-rhombic or linear-attenuate, 6-9 : 1. 2. *robustum*.

1. BRACHELYMA SUBULATUM (P. B.) Sch. Syn. (Ed. 2) 557. 1876.

Fontinalis subulata P. B. l. c.

Dichelyma subulatum Myr. l. c.

Cryphaea inundata Nees l. c.

Neckera subulata C. Müll. Syn. l. c.

Cryphaeadelphus subulatus (P. B.) Card. Rev. Bryol. 31: 6. 1904.

Plants floating, flaccid, dull green or yellowish; stems slender, 12-20 cm. long, denuded at the base, regularly pinnately divided; branches very distant, unequal, spreading, occasionally slightly curved; leaves slightly distant on the stem and principal branches, much closer on the younger growth, tristichous, erect-spreading or loosely imbricate, keeled-conduplicate, decurrent, oblong-lanceolate, acuminate, 2-4 mm. long, 0.35-1 mm. wide, 3.5-7 : 1; costa percurrent or disappearing slightly below apex; apices acute to obtuse, more or less denticulate; median leaf cells short, irregular, hexagonal-rhombic, 5-8.5 μ wide, 2-4 : 1, sometimes 6-7 : 1; the marginal linear-attenuate, 6.8-8.5 μ wide, 10-15 : 1, forming a marginal zone of 4 or 5 rows of cells, less distinct or disappearing toward the apex; alar cells and basal cells quadrate or rectangular, auricles not distinct. According to Cardot, perichaetium oblong; perichaetial leaves ecostate, oblong-lanceolate or linear-lanceolate, rather long-acuminate, entire; seta very short, 1-1.5 mm. long; capsule completely immersed, pale yellowish, oval, 1.5-2 mm. long, 0.75-1 mm. in diameter; operculum convex-conical; beak oblique; calyptra small, very fugacious, covering only the operculum; peristome yellowish, teeth linear, finely granulose, with 8-10 lamellae; cilia narrow, finely papillose, nodulose, or appendiculate, united or free at the apex.

Type locality, Georgia; collected by Palisot de Beauvais.

ILLUSTRATIONS:—Bry. Eur. pl. 434; Myrin, l. c. pl. 7B; Engler & Prantl (Ed. 2) 11: fig. 477; Pl. 79.

EXSICCATI:—Drumm. Musc. Am., S. States 153, Small, Georgia Mosses 5068, 5079; Harper, Alabama Plants 104; Langlois, La., July 9, 1893; Mohr, Mobile, Ala.; Schallert, 514, N. C.

In streams and rivers, in Louisiana, Alabama, and Georgia; also in Arkansas and Illinois, according to Cardot.

B. subulatum is easily distinguished by plants slender, leaves keeled-conduplicate, costate, median leaf cells hexagonal-rhombic, marginal zone of four or five rows of cells linear-attenuate, alar cells small, quadrate to rectangular.

2. BRACHELYMA ROBUSTUM (Card.) E. G. Britt. Bryol. 7: 48. 1904.

Cryphaeadelphus robustus Card. Rev. Bryol. 31: 8. 1904.

Plants floating, rather robust, rigid, yellowish-green to dull or brownish-green; stems 10-20 cm. long, denuded at the base, pinnately to bipinnately branched; branches numerous, rigid, spreading; leaves close, very distinctly tristichous, erect-spreading, subimbricate or imbricate, keeled-conduplicate, decurrent, oblong-lanceolate, gradually and broadly acuminate, 3-4 mm. long, 1-1.5 mm. wide, 2-3 : 1; costa percurrent or disappearing slightly below the apex; apices obtuse, more or less broad and cucullate, subentire to denticulate; interior leaf cells linear-rhombic or linear-attenuate, only slightly shorter than the linear-attenuate marginal cells, 6.5-8.5 μ wide, median 6-9 : 1, marginal 10-13 : 1; alar cells and basal cells rectangular or quadrate, not forming auricles. According to Cardot, perichaetial leaves like those of *B. subulatum*.

Type locality, Limestone Creek, Pulaski Co., Georgia; collected by Roland M. Harper in 1902.

ILLUSTRATIONS:—Pl. 79.

EXSICCATI:—Harper, Georgia Plants 1919a, near Colquitt, Miller Co., Aug. 4, 1903, assumed to be cotype or duplicate type; 2142a, near Dublin, Apr. 21, 1904; 1377a, Pulaski Co., June 27, 1902.

This species has been reported only from the swamps in Georgia.

B. robustum is distinguished from *B. subulatum* by plants more or less robust, rigid, pinnately to bipinnately branched, leaves very distinctly tristichous, apices obtuse, more or less broad and cucullate, median leaf cells linear-rhombic or linear-attenuate and slightly shorter than the linear-attenuate marginal cells.

✓ 3. DICHELYMA Myr. in Act. Reg. Acad. Scient. Holm. 274. 1832 (emend.).

Fontinalis sp. Hedw. Descr. 3: 57. 1792.*Neckera* Sect. 9, *Dichelyma* Subsect. 1, *Eudichelyma* C. Müll. Syn. 2: 143. 1850.

Plants growing at edge of water, inundated or entirely submerged; slender to robust, green to golden-brown, blackish below, variously branching; branches recurved at apex; leaves tristichous, narrowly lanceolate to lanceolate-subulate, falcate-secund to circinate, keeled-conduplicate, slightly denticulate; costa percurrent to long-excurrent; median leaf cells linear-attenuate; basal cells shorter; alar cells no wider or very slightly so, yellowish; auricles none; perichaetium very elongate-cylindrical; perichaetial leaves long, convolute or tubular, more or less spirally twisted around the seta, strap-shaped or linear-acuminate, ecostate, apices entire or slightly denticulate. Capsule ovate, rather long pedicellate, surpassing the perichaetium or emerging laterally; operculum conic-rostrate, about as long as urn, frequently oblique and curved; calyptra split along one side, large, covering the entire capsule; peristome double, teeth 16, lance-linear, erect, obtuse, papillose, frequently more or less cleft along the median line, with few distant lamellae; cilia filiform, generally longer than the teeth, occasionally falling with the operculum, sometimes free, sometimes united at the apex by transverse strands, or forming a perfect trellis; transverse strands not appendiculate; spores small and more or less uniform in size.

The plants of this genus are distinguished from those of *Fontinalis* by their distinctive habit; leaves costate, midrib often excurrent; perichaetium very elongate-cylindric, perichaetial leaves strap-shaped or linear-acuminate, generally spirally twisted; calyptra split along one side, entirely covering the capsule; peristome teeth with fewer lamellae, meshes of trellis not wider than high, and transverse bars never appendiculate. *Dichelyma* differs from *Brachelyma* chiefly in leaves narrowly lanceolate, homotropous-falcate, perichaetium very elongate-cylindrical, perichaetial leaves convolute, more or less spirally twisted, strap-shaped or linear-acuminate, capsule long-pedicellate, surpassing the perichaetium, and calyptra covering the entire capsule. *Dichelyma* has been reported from North America, Europe, and Asia.

KEY.

- | | |
|--|-------------------------|
| 1. Costa subpercurrent, percurrent, or briefly excurrent. | 2. |
| Costa long-excurrent. | 3. |
| 2. Costa percurrent or briefly excurrent, leaves acuminate-subulate; inner perichaetial leaves strap-shaped, long-acuminate; capsule emerges at end of perichaetium; trellis perfect. | 1. <i>falcatum</i> . |
| Costa subpercurrent or percurrent, leaves acuminate, acute to obtuse; inner perichaetial leaves linear, long-acuminate; capsule emerges laterally from perichaetium; trellis imperfect, cilia free with exception of apices united by 2 or 3 transverse strands. . . | 4. <i>pallescens</i> . |
| 3. Leaves falcate-secund, 4-5 mm. long, apices long-subulate; inner perichaetial leaves linear, rather long-acuminate, not twisted or only slightly so; capsule erect, reaching apices of perichaetial leaves or surpassing them; trellis perfect. | 2. <i>uncinatum</i> . |
| Leaves erect-spreading or subsecund, the younger frequently falcate-secund, 5-7 mm. long, apices long-subulate; inner perichaetial leaves acuminate, spirally twisted; capsule erect or oblique, at first immersed, later laterally emergent; trellis imperfect, cilia free with exception of apices united by 2 or 3 transverse strands | 3. <i>capillaceum</i> . |

1. DICHELYMA FALCATUM (Hedw.) Myr. l. c.

Fontinalis falcata Hedw. Musc. Frond. 3: 57. 1792. and Sp. Musc. 299. 1801.*Neckera falcata* C. Müll. l. c. 143.

Plants commonly glossy and bright green when young, later yellowish-green, brownish, or copper-colored above, often blackish below; stems 5-15 cm. or more long, irregularly divided or slightly pinnate; branches distant, ascending or spreading, slightly flattened, more or less uncinatate at the end; leaves close, imbricate at base, falcate-secund, keeled-conduplicate, oblong-lanceolate, then gradually narrowed, acuminate-subulate, 3-5 mm. long, 0.75-1.35 mm. wide; margins plane or slightly revolute, entire in lower $\frac{2}{3}$ or $\frac{3}{4}$, denticulate toward the apices; costa usually excurrent, frequently percurrent or almost so; median leaf cells linear-attenuate, 5-6.5 μ wide, 10-20 : 1; basal cells golden-yellow; alar group inconspicuous; perichaetium very long, narrowly cylindrical; inner perichaetial leaves ecostate, strap-shaped, long acuminate, entire or slightly denticulate toward

the apex, clasping at the base, *spirally twisted around the seta*; *seta* erect, reddish, usually passing at considerable length beyond the perichaetial leaves, 5–15 mm. long; *capsule* erect, oval, oval-oblong, or cylindric, rounded at the base, occasionally contracted beneath mouth when dry, yellowish or rust-brown, sometimes darkening with age, 1.25–2 mm. long, 0.50–0.90 mm. in diameter; operculum conical-acuminate, commonly as long as the urn, obliquely beaked; calyptra longer than the capsule, base closely clasping the seta; peristome reddish or yellowish-orange, teeth linear, about 0.5 mm. long, strongly papillose, with articulations rather close; *trellis* perfect, rust-brown, muricate, cilia longer than the teeth, about 0.6 mm. in length; spores smooth or minutely papillose, 10–14 μ in diameter, ripe in summer.

Type locality, northern Europe.

ILLUSTRATIONS:—Hedwig, *Musc. Frond.* 3: *pl.* 24; Myrin, l. c. *pl.* 6; Bryol. Eur. *pl.* 433; Engler & Prantl (Ed. 2) 11: *fig.* 478; Limpricht, pp. 675 & 676; Husnot, *Musc. Gall.* *pl.* 81; *Pl.* 70.

EXSICCATI:—Sullivan & Lesquereux, *Musc. Bor. Am.* (Ed. 1) 229b, New Eng.; (Ed. 2) 343; Grout, N. Am. *Musc. Pl.* 396, Conn.

I have examined specimens collected in sloughs, swamps, streams, and lakes, in Labrador, Ontario and Alberta, Canada, and in the United States in Washington, Oregon, Minnesota, New Hampshire, and Maine. The range of this species in North America is Canada and northern United States. Also in Northern Europe and Northern Asia.

D. falcatum is distinguished from other species of *Dichelyma* by leaves oblong-lanceolate, gradually narrowed into acuminate-subulate apices, falcate-secund, costa usually excurrent, occasionally percurrent, inner perichaetial leaves strap-shaped, very long acuminate, spirally twisted around the seta, capsule surpassing the perichaetium, and trellis perfect. Sterile plants of *D. falcatum* resemble those of *Drepanocladus* but are distinguished by the absence of enlarged alar cells.

2. DICHELYMA UNCINATUM Mitt. in Journ. Linn. Soc. 8: 44. 1864.

Dichelyma capillaceum C. Müll. ms. in *Musc. Roell.*, not Bryol. Eur., (according to Cardot).

Dichelyma cylindricarpum Aust. in Bot. Gaz. 2: 111. 1877.

Dichelyma uncinatum Mitt., var. *cylindricarpum* (Aust.) Card. in Mon. Font. 139. 1892.

Plants yellowish-green and frequently glossy above, brownish or blackish at the base; stems more or less regularly pinnate, 6–12 cm. long, denuded below; branches distant, spreading, uncinatate at the end; leaves rather close, *tristichous*, *falcate-secund*, *keeled-conducuplicate*, *oblong-lanceolate*, then gradually narrowed and *long-subulate*, 4–5 mm. long, 0.50–0.65 mm. wide, margins plane or slightly revolute toward the middle, denticulate or sinuate in the upper one-third or one-half, sometimes entire; costa long-excurrent, frequently denticulate at the apex only; median leaf cells linear-attenuate, 5–6.5 μ wide, 12–20 : 1; alar cells indistinct; perichaetium narrowly elongate-cylindric; inner perichaetial leaves linear, rather long-acuminate, entire or subdenticulate toward the apex, sheathing, convolute, not twisted or only slightly so; seta reddish, 4–6 mm. long, frequently up to 12 mm. in length; capsule erect, extending to the apices of the perichaetial leaves or surpassing them, small, oblong-subcylindric, oval-oblong or cylindric, brownish to yellowish, sometimes slightly curved, rounded or more or less attenuate at the base, sometimes slightly contracted beneath the mouth and wrinkled when dry, 1.25–1.50 mm. long, occasionally 2 mm. in length, 0.50–0.65 mm. in diameter; operculum conic-acuminate; according to Mitten, calyptra not adhering to the seta by the base; peristome teeth orange, linear-subulate, almost as long as the trellis, papillose, with 12–18 articulations; trellis orange-brownish, perfect, strongly papillose, exceeding outer peristome by about one-fifth of length of teeth; spores finely muricate.

Type locality, Fort Colville, British Columbia, Canada; collected by Lyall.

ILLUSTRATIONS:—Mitten, Journ. Linn. Soc. 8: *pl.* 8; *Pl.* 79.

EXSICCATI:—Lyall, near 49th parallel of Lat., Oregon Boundary Commission 1858–1859, in Farlow Herb.; from Fort Colville to Rocky Mts., 1861, in Farlow Herb.; Grout, N. Am. *Musc. Pl.* 92, B. C., 92A, Wash.; Piper, 103, Wash.; Foster, 398, Wash.; Howell, Ore. in 1886; Holzinger & Blake, Mosses of north-western Minn. 43; Leiberger, Mosses of Kootenai Co., Idaho, 81; Macoun, Canadian Musci 194, 211, 234, 607, B. C.; 761, along L. Superior, Ont.; 213, Vancouver Id.

In mountain streams and basins, lakes, rivers, and ponds, in northern United States and southern Canada, especially in the western portions.

D. uncinatum is distinguished from *D. falcatum* by habit more slender, leaves more setaceous because of the excurrent costa which is usually more or less smooth beyond the denticulate or sinuate margins, and frequently denticulate only at the apex, perichaetial leaves not twisted, and inner peristome exceeds the external teeth by about one-fifth of their length.

I am unable to find any constant distinguishing characteristics by which *D. uncinatum* Mitt. and var. *cylindricarpum* (Aust.) Card. can be separated when not in fruit. The leaves and leaf apices vary but leaves

on the same plants show the same variations in size, width of apices, denticulation, etc. Although the setae in the variety are usually much longer than those of the species, several sporophytes were found in which the setae of the variety were about the length of those in the species. Cardot, in Mon. Font., p. 140, states that it is impossible to separate the two definitely and that the seta length is a variable factor in most mosses and is probably subject to rather great variation in *Dichelyma* also. The seta length and capsule size given for var. *cylindricarpum* are included in the description of *D. uncinatum* and the exsiccati of the variety and the species have been combined.

3. *DICHELYMA CAPILLACEUM* [Dill.] Bryol. Eur. 5: fasc. 31, Suppl. 1. 1846, not Myrin.

Dichelyma capillaceum β *subulifolium* Bryol. Eur. 5: 8. 1842.

Neckera capillacea C. Müll. Syn. 2: 144. 1850.

Dichelyma pallescens Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 346, 1865, not Bryol. Eur., according to Cardot.

Dichelyma capillaceum BS., var. *elongatum* Kindb. in Macoun, Cat. Can. Pl. 6: 160. 1892.

Plants slender and rather delicate, more or less glossy, yellowish-green or brownish above, dull green or blackish below; stems slender, 5–15 cm. long, more or less irregularly pinnate, sometimes denuded below; branches distant, spreading, distichous or homotropous, slightly flattened, generally curved at the end, sometimes slightly falcate; leaves rather close to distant, occasionally up to 1 mm. apart, commonly erect-spreading or subsecund, the younger frequently falcate-secund, keeled-conduplicate, oblong-lanceolate, gradually narrowed, long subulate; 5–7 mm. long, 0.50–0.65 mm. wide; margins plane or slightly revolute toward the middle, entire or subdenticulate above; costa long-excurrent, denticulate or entire at the end; median leaf cells linear-attenuate, 6–7 μ wide, 10–20 : 1; alar cells indistinct; perichaetium elongate-cylindric; inner perichaetial leaves acuminate, entire or subdenticulate toward the apices, clasping, convolute, spirally twisted, surpassing the capsule; seta 3–4 mm. long, completely hidden in the perichaetial leaves; capsule at first immersed in the perichaetium, later laterally emergent, erect or oblique, oval or oval-oblong, yellowish, rounded at the base, 1–1.5 mm. long, 0.50–0.65 mm. in diameter; operculum convex-conic, beak oblique; calyptra large, covering the entire capsule; peristome orange; teeth linear, strongly papillose, with 10–15 articulations; cilia well-developed, articulate, strongly papillose, much longer than the teeth, free almost their entire length, united at the apex with 2 or 3 transverse strands; spores smooth or finely muricate, 10–15 μ in diameter, ripe in summer.

Type locality, Europe.

ILLUSTRATIONS:—Bryol. Eur. pl. 436; Grout, M.H.M. fig. 219; Pl. 79.

EXSICCATI:—Drumm. Musc. Am. 234 in part; Sull. Musc. Allegh. 151; Sull. & Lesq., Musc. Bor. Am. (Ed. 2) 345 & 346; Austin, Musc. Appal. 252; Renaud & Cardot, Musc. Am. Sept. Exsicc. 187, Conn.; Grout, N. Am. Musc. Pl. 46, Vt.; 344, Quebec.

In streams, rivers, pools, ponds, and swamps in eastern United States and Canada, from New Brunswick and Ontario southward to North Carolina and Tennessee. Also in Europe.

In sterile condition, *D. capillaceum* and *D. uncinatum* resemble each other rather closely. *D. capillaceum* is more slender and delicate, leaves commonly longer subulate, erect-spreading, slightly secund, the younger falcate-secund. When fertile, *D. capillaceum* is characterized by inner perichaetial leaves acuminate, clasping, convolute, spirally twisted, surpassing the capsule; and trellis imperfect.

No material of *D. capillaceum* Bryol. Eur., var. *elongatum* Kindb. has been available. Kindberg's description "stems more elongate, branches more distant, the leaf base longer than the excurrent part of the costa" indicates that it may be a form of *D. capillaceum*. Since these characteristics in aquatic mosses are subject to more or less change, I prefer to consider *D. capillaceum*, var. *elongatum* as a synonym of *D. capillaceum*.

4. *DICHELYMA PALLESCENS* Bryol. Eur. 5: fasc. 31, Suppl. 1. 1846.

Dichelyma capillaceum Myr. l. c.

Fontinalis capillacea Hook. & Wils. in Drumm. Musci Amer. 234 in part, 1841, not Dicks., according to Cardot.

Neckera leucoclada C. Müll. Syn. 2: 144. 1851.

Dichelyma Novae-Brunsviciae Kindb. in litt., according to Cardot.

Dichelyma obtusulum Kindb. in Macoun Cat. Can. Pl. 6: 159. 1892.

Plants yellowish, slightly glossy, or of a pale and dull green; stems very slender, 3–8 cm. long, irregularly and subpinnately branched, generally denuded at the base; branches distant, spreading, slightly flattened, more or less curved at the end; leaves rather close or only slightly distant, secund, slightly falcate, keeled-conduplicate, oblong-lanceolate, gradually narrowed, acuminate, acute, subobtuse, or obtuse, 3–4 mm. long,

0.65 mm. wide, margins plane, denticulate toward the apex, rarely subentire, *costa percurrent or subpercurrent*; median leaf cells linear-rhombic, 6.5–8.5 μ wide, 8–15 : 1; alar cells indistinct; perichaetium narrowly elongate-cylindric; *inner perichaetial leaves linear, long-acuminate, entire, clasping, convolute, spirally twisted*; seta 4–6 mm. long, entirely hidden in the perichaetial leaves; *capsule small, emerging laterally from the perichaetium or slightly surpassing it*, erect or oblique, oval-oblong or subcylindric, rounded or slightly attenuate at the base, yellowish, 0.65–1.25 mm. long, 0.35–0.50 mm. in diameter; operculum conic-acuminate; *calyptra large, the base clasping the seta*; peristome orange; teeth linear, finely papillose, with 8–12 articulations; *cilia narrow, articulate, finely papillose, longer than the teeth, entirely free or united at the apex with 2 or 3 transverse strands*; spores smooth, 10–13.5 μ in diameter.

Type locality, North America.

ILLUSTRATIONS:—Bryol. Eur. 5: pl. 435; Grout, M.H.M. fig. 220; Jennings, Mosses W. Pa. pl. 31; Pl. 79.

EXSICCATI:—Drumm. Musc. Am. 234 in part; Austin, Musci Appal. Suppl. 1, 525; Fernald, Flora of Maine 139; Merrill, E. D., Flora of Maine 117; Burnett, 2768, N. Y.; Grout, N. Am. Musc. Pl. 121, 121a, N. Y.; Fowler, 534, 609, N. B.; Macoun, Canadian Mosses 210, 235, Ont.

Along creeks and around ponds, New Brunswick to Minnesota and Pennsylvania. According to Cardot, in Rocky Mts., reported by Drummond.

D. pallescens is characterized by leaves secund, slightly falcate, keeled-conduplicate, oblong-lanceolate, gradually narrowed, acuminate, acute to obtuse, costa percurrent or subpercurrent, inner perichaetial leaves linear, long-acuminate, convolute, spirally twisted, capsule emerging laterally from perichaetium or slightly surpassing it, and cilia longer than teeth, and entirely free or united at apex with 2 or 3 transverse strands. When in sterile condition, *D. pallescens* is distinguished from other species in *Dichelyma* by leaves not acuminate-subulate, and only slightly falcate.

EXCLUDED SPECIES.

I consider *Dichelyma brevinerve* Kindb., Rev. Bryol. 4: 99. 1909, *Dichelyma Swartzii* Lindb. in Hartm. Skand. Fl. (Ed. 8) 353, 1861, *D. longinerve* Kindb. in Bull. Torr. Bot. Club 16: 97, 1889, and, according to Cardot, *D. californicum* Aust. in herb. as belonging to *Drepanocladus*. I have excluded these from the genus *Dichelyma* because the leaves are not keeled-conduplicate and the alar cells are enlarged and distant, forming more or less apparent auricles.

(It was not practicable to examine all numbers of Sullivant and Lesquereux, Musc. Bor. Am. (Ed. 2), or Sullivant, Musc. Allegh., and none of either set of Drummond, Musc. Am. S. States; hence Cardot's statements concerning the different unexamined species in these sets have been accepted.)

ADDITIONS

SUPPLEMENTARY KEY TO MOSSES IN VOLUME THREE

1. Leaves papillose. 2.
 Leaves not papillose. 15.
2. Papillae formed by projecting cell angles. *Hydnaceae* sp. and *Pterogonium*.
 Papillae over cell lumen*. 3.
3. Leaves with a strong spreading double costa reaching beyond middle
 of leaf. *Callicostella*.
 Costa single, or short, or lacking. 4.
4. Costa short often faint and double or lacking. 5.
 Costa well developed, mostly single and reaching leaf middle. 6.
5. Leaf cells rarely over 3 : 1, often shorter. *Leskeaceae* and *Schwetschkeopsis*.
 Leaf cells more than 3 : 1. *Taxithelium*.
6. Leaf cells with a single papilla at back. 7.
 Leaf cells with two or more papillae at back on some or all. 11.
7. Papillae very large and sharp. 8.
 Papillae relatively low and small. 9.
8. Plants large, dendroid, circinate when dry, dark green. *Dendroalsia*.
 Plants smaller, light green to glaucous. *Thelia*.
9. Leaves somewhat complanate; plants subtropical. *Stereophyllum*.
 Leaves not at all complanate. 10.
10. Capsules immersed. *Cryphaea*.
 Capsules on a long seta. *Leskeaceae*.
11. Leaves strongly auriculate. 12.
 Leaves not auriculate. 13.
12. Auricles fimbriate-papillose. *Anomodon Rugelii*.
 Auricles scarcely papillose. *Tricholepis*.
13. Leaf cells less than 5 : 1, mostly dense and subopaque. *Leskeaceae*.
 Leaf cells more than 5 : 1, not dense or opaque. 14.
14. Margins plane. *Barbella*.
 Margins revolute. *Leucodontopsis*.
15. Costa strong, single, reaching leaf middle or beyond. 16.
 Costa not as above. 25.
16. Leaves strongly complanate. 17.
 Leaves not complanate. 18.
17. Plants with small differentiated under leaves (amphigastrea). *Hypopterygium*.
 Plants without amphigastrea. *Porothamnium* and *Neckeraceae*.
18. Leaves squarrose. *Campyllum*, *Jaegerinopsis* and *Hylocomiaceae*.
 Leaves not squarrose. 19.
19. Median leaf cells 4 : 1 or less. 20.
 Median leaf cells 5-20 : 1. 23.
20. Plants minute; leaves soft and delicate; leaf cells thin-walled. *Fabroniaceae*.
 Plants small to large; leaves more rigid when dry; leaf cells mostly
 thick-walled. 21.
21. Costa strong, nearly reaching apex, markedly flexuous. *Herpetineurum*.
 Costa various but not flexuous. 22.
22. Capsules exserted on a long seta. *Leskeaceae* and *Hydnaceae*.
 Capsules on a short seta, immersed to shortly exserted. *Cryphaeaceae* and *Leucodontaceae*.
23. Plants rarely fruiting, subtropical, confined to Florida and the Gulf
 coast. *Meteoriopsis*, *Pirella* and *Pseudocryphaea*.
 Plants found in all parts of N. America. 24.

* See also *Leucodon julaceus* and *Pseudocryphaea*.

24. Aquatic; perichaetial leaves longer than the seta..... *Brachelyma* and *Dichelyma*
(except *Dichelyma* sp.)
Rarely aquatic; seta much longer than the perichaetial leaves..... *Hypnaceae*.
25. Costa double and strong, reaching leaf middle..... *Hookeriaceae*.
Costa short to lacking..... 26.
26. Leaves strongly complanate..... 27.
Leaves not complanate..... 28.
27. Leaves soft and thin; leaf cells 50-60 μ wide..... *Hookeria*.
Leaves mostly of firmer texture; leaf cells much narrower..... *Neckera* and *Hypnaceae* species
28. Aquatic, long and floating; capsules immersed..... *Fontinalis*.
Rarely aquatic, if so only a few centimeters in length..... 29.
29. Capsules exerted on a long seta..... *Hypnaceae*.
Capsules immersed..... *Leptodon* species.

BESTIA OCCIDENTALIS (Sull. & Lesq.) n. comb.

Hypnum occidentale Sull. & Lesq. Sull. Icones Musc. Suppl. 105. pl. 81. 1874.

Isoetecium occidentale Williams, Bryol. 29: 48. 1926.

Pseudoleskeopsis occidentalis Grout, Ck. List 25. 1929.

Plants in rather thin, densely interwoven mats, light to yellowish green, having much the appearance of a *Heterocladium* or a slender *B. Breweriana*; stems much divided, 2-4 cm. long, prostrate, filiform, the ultimate divisions more or less pinnately branched with branches of unequal length, which are slender and often attenuate; leaves closely imbricate when dry, erect-spreading when moist; stem leaves oblong-ovate, acute to obtuse, 0.6-0.8 mm. long, somewhat concave, not decurrent; margins plane and more or less serrulate above; costa simple, reaching to about the leaf middle; median cells oblong to elliptical, 7-8 μ wide, about 2 : 1, often subhexagonal near apex, gradually but slightly elongated at middle base, a considerable area of subquadrate angular cells; the marginal cells are smaller than the median; leaves of ultimate branches and branchlets smaller, more serrate and more nearly oblong, more rounded-obtuse; perichaetial leaves sheathing at base, the inner with spreading tips. Dioicous; seta smooth, \pm 1.5 cm. long; capsule oblong-ovoid to oblong-cylindric, somewhat inclined; operculum long-conic to subrostrate; peristome perfect hypnaceous with two well developed cilia; annulus lacking. Type locality, Oregon, Hall.

ILLUSTRATIONS:—Sull. l. c.; Pl. 71.

EXSICCATI:—Grout, N. Am. Musc. Pl. 252; Allen, Mosses Cascade Mts. 90b (at least in the author's set). According to Dr. Best in his Monograph on *Heterocladium* (Bull. Torr. Bot. Club 28: 129), this species is often associated with *H. heteropteroides* and Allen's 90b (issued as *H. heteropterum*, Det. Best) is likely to be mixed. On moist rocks, especially in crevices; Oregon, Washington, and Vancouver Island.

This species was overlooked in the Lesq. & James Manual and besides the synonymy given above it has been put in *Thuidium*, *Heterocladium* and *Pseudoleskeella* by Kindb. Brotherus has apparently overlooked it. (See Ed. 2 of Engler-Prantl.)

BRYHНИЯ HULTENII Bartram. n. sp.

"Dioica, gracilis, pallide lutescenti-viridibus, nitidis. Caulis repens, parce radiculosus, subpinnatim ramosus, ramis ad 15 mm. longis, attenuatis. Folia caulina ad 1.1 mm. longa, longe decurrentia, plicata, e basi cordata late ovata, obtusa vel truncata, minute apiculata; marginibus erectis, superne inequaliter serratis, nervo sat tenui, ad medium folii evanido; cellulis anguste rhomboideis, papillose exstantibus, alaribus rectangularibus, hyalinis. Folia ramea minora, acuta vel acuminata. Bractae perichaetii e basi vaginante sensim in acumen denticulatum attenuatae. Caetera ignota." (Bartram.)

Plants light yellow-green, irregularly divided, subpinnately branching, stems 3-4 cm. long, apparently ascending, stem leaves shortly deltoid-ovate, about 1 mm. long by 0.8 mm. wide, abruptly narrowed to the insertion, obtuse or usually short-apiculate, very concave and subcucullate at apex, strongly decurrent, finely serrulate all around, faintly costate to about the middle; median leaf cells linear, 6-9 μ wide, \pm 5-8 : 1, marginal and apical cells shorter; at the rounded basal angles a large group of small rounded rather irregular cells, below these a group of very large inflated cells, reaching 35 x 90 μ , hyaline or somewhat colored, reaching half way to the costa and long decurrent on the stem; branch leaves ovate, acuminate, serrulate, with shorter leaf cells, papillose at back by projecting cell-angles.

Type from Kodiak Island, Alaska, 4-27-1932, Eric Hultén No. 5135; also from Sitkalidak Id., Port Hobron, Sept. 5, 1931, W. J. Eyerdam no. 36c.

The pale yellowish color, the short, faint costa, the rounded, apiculate stem leaves and the short pointed branch leaves seem to adequately distinguish this species from any of the forms of *Bryhnia Nova-Angliae* (Sull. & Lesq.) and from any of the Japanese species of *Bryhnia* which are available for comparison. Type in herb. Bartram and herb. A. J. G.

No antheridia present. Except for papillae at back of branch leaves this would certainly be placed in *Calliergon*.

RHYNCHOSTEGIELLA GEORGIANA Dixon & Grout, Bryol. 33: 27. pl. 4. 1930.

Plants slender, irregularly branching, loosely sprawling over the substratum, yellowish green, apparently somewhat complanate-foliate; stems 5-10 mm. long; leaves spreading at an angle of about 60° when dry, more widely spreading when moist, shrunken and more strongly concave when dry, narrowly lanceolate, broadest about $\frac{1}{4}$ the length from the base, gradually and evenly narrowed to the slender-pointed apex, 1.5-2 mm. long by about $\frac{1}{10}$ as broad, with plane entire margins; leaf cells narrowly linear-rhomboidal, median 70-100 μ long by 6-9 μ wide, shorter and broader near the base; basal rectangular; costa well developed below, vanishing above the middle. Apparently dioicous as sporophytes and antheridia were observed on separate plants; inner perichaetial leaves broader, ovate at base with a stronger costa; seta yellowish reaching 2-2.5 cm. in length, smooth; capsule short-oblong, cernuous and unsymmetric at base, about 1.25 mm. long and more than half as broad, not contracted below its mouth when dry and empty; annulus, operculum and calyptra lacking; peristome perfect, cilia (2) and segments nearly or quite the length of the teeth, upper part of teeth, cilia and segments granulose, and nearly hyaline; stomata few, at the very base of the capsule. Pl. 80.

On rotten log in swamp of Ocmulgee R. about two miles below Macon, Bibb Co., Georgia. R. M. Harper, Georgian Plants 1884c. Type in British Museum; cotype in herb. A. J. Grout, com. H. N. Dixon.

"Differs from *R. tenella* (Dicks.) Limpr. in the more robust, much laxer growth, distant, \pm complanate, widely spreading leaves, longer, fully 1 mm. (there .6-.9 mm.), less finely subulate, quite entire (there usually with a suspicion at least of denticulation); nerve shorter and weaker; cells slightly but appreciably wider, and more pellucid; 6-7 μ wide (there 5-6 μ); and very markedly in the longer seta \pm 2 cm. (there about 1 cm., often much shorter)."

"*R. Jaquinii* (Garov.) Limpr. has a slightly nearer approach to it in habit, but in all other characters is at least equally if not more distinct, and has a rough seta."

"*R. curviseta* has a very appreciably wider leaf and wider acumen in proportion to length, margin usually finely denticulate, and short rough seta, except in var. *laeviseta* Nichols & Dix. where the seta, while smooth is much shorter."

"It is more nearly like some Asiatic species; indeed the South Indian *R. leiopoda* Dix. & Varde differs very little except in the much shorter seta." H. N. D.

HYGROAMBLYSTEGIUM MACRONEURON Grout, Bryol. 36: 1. 1933.

Plants in deep loosely interwoven masses, dark to bright green above, brown and lime incrust below; stems 3-5 cm. long, irregularly to subpinnately branching; cortical stem cells small, inside these 2-3 rows of slightly larger thick-walled cells, central strand of a few narrow cells or lacking, the other inner cells large, parenchymatous in cross-section, about 30 μ in diameter; leaves from the upper middle region of branches \pm 0.5 mm. wide \times \pm 1.7 mm. long, oblong-lanceolate, obtusely acute at apex, not decurrent, serrulate to the middle or below; costa $\frac{1}{3}$ the width of the leaf base, very thick and strong, diffusing and disappearing in the apex, in cross-section elliptical in the leaf middle and composed of uniform thick-walled cells except the somewhat smaller outer layer, near the apex the costa often forks, and often one or more slender branches are given off from the lower portion; lower stem leaves shorter and more acute; median leaf cells 30-40 \times \pm 6 μ , oblong to linear, flexuose; basal shorter, alar not differentiated. Archegonia and antheridia not found. Pl. 80.

Type from near Junction, Texas, in springs along the banks of the Llano River, Jan. 1, 1932. Comm. Miss Eula Whitehouse.

Here we have another case of tremendously thickened costa in the Hypnaceae associated with lime in solution.

The generic affinities of this plant are uncertain until sporophytes are found. It is placed in *Hygroamblystegium* because of the branched costa and elongated leaf cells.

SCIAROMIUM FRYEI Williams, Bryol. 35: 52. 1933.

Flowers and fruit unknown: plants up to 7 cm. or more high, with wiry stems, bearing irregular, flexuous branches; the stems in cross section oval, about .4 mm. by .3 mm. in diameter, showing a small central strand and thick-walled outer cells in 3 or 4 rows; leaves rather distant, flexuous-spreading when dry, those of stem up to 3.5 mm. long, rather broadly lanceolate, the margins often serrulate nearly all round, of a single thickness of cells and in places only 1 cell wide or entirely lacking, just within which is a broad band of elongate cells, 2 layers in thickness, extending from near the base to the short-excurrent, stout costa; upper branch leaves very similar to those of stem but smaller; leaf-cells small, smooth, irregular and angular, the median 6-8 μ wide and up to 16 μ long, quite similar to near base, the larger basal cells extending across leaf in about 2 rows. *Pl. 80.*

Type collected in more or less wet pasture land at Cape Arago, Oregon, Aug. 8, 1922 by T. C. Frye.

HYLOCOMIUM SPLENDENS (Hedw.) Bry. Eur. var. *tenue* Sharp. Bryol. 36: 21. 1933.

Stems slender, attenuate, sparingly bipinnately branched; stem leaves similar to the branch leaves; paraphyllia rare. Found growing in mats closely adpressed to the perpendicular surfaces of rocks.

TYPE:—On siliceous rocks, Roaring Fork Creek, Mt. Le Conte, Sevier Co., Tennessee. alt. 5500 ft. May 8, 1932. The type material is deposited in the herbarium of The University of Tennessee.

This variety was also found on a similar substrate, Rainbow Falls, Mt. Le Conte, Sevier Co., Tennessee. 4000 ft. Sept. 29, 1930. This collection is to be found in The University of Tennessee herbarium.

These plants have somewhat the gross appearance of *Hygrohypnum micans* (Wils.) Broth. but are of a darker copper color.

CORRECTIONS

CORRECTED KEY TO THE SUBFAMILIES OF HYPNACEAE p. 3.

1. Costa strong and extending to the middle of the leaf or beyond, usually single. (Exceptions in *Hylocomium* and *Campylium*)..... 4.
- Costa short and double or lacking..... 2.
2. Capsules erect and symmetrical, or nearly so; cilia rudimentary or lacking..... *Entodontaceae*.
- Capsules more or less cernuous, unsymmetrical..... 3.
3. Plants complanate-foliate (exc. *Plagiothecium striatellum* and *P. latebricola*); leaves seldom secund..... *Plagiotheciaceae*.
- Plants not complanate-foliate, leaves usually more or less secund..... *Hypnaceae*.
4. Plants large, secondary stems dendroid from creeping or stoloniferous primary stems... 5.
- Plants smaller, not dendroid..... 6.
5. Capsules erect and symmetrical (Exc. *Girgensohnia*); peristome without cilia..... *Climaciaceae*.
- Capsules curved, peristome perfect..... *Porotrichaceae*.
6. Plants complanate-foliate..... *Stereophylleaceae*.
- Plants not complanate-foliate..... 7.
7. Capsules ovoid, short, thick and unsymmetric with few exceptions, often little contracted under the mouth when dry; stem and branch leaves often quite different... 8.
- Capsules longer, arcuate-cylindric as a rule, usually more contracted under the mouth when dry..... *Amblystegiaceae*.
8. Costa single and usually reaching well beyond middle of leaf; seta often rough; paraphyllia lacking..... *Brachytheciaceae*.
- Costa frequently double, often short; paraphyllia large and abundant in many species; seta smooth..... *Hylocomiaceae*.

p. 9, line 2, for Vancouver, read Vancouver Island.

p. 19. Substitute EURHYNCHIUM SUBSTRIGOSUM Kindb. for *E. fallax* (R. & C.) Grout, as it has six years priority. Type seen.

p. 22, line 17, Holzinger's number is 330, not 530.

p. 23. The range of *Eurhynchium serrulatum*, eastern U. S., Vermont to Texas, west to Kansas.

p. 24, line 23, read CIRRIPHYLLUM Grout.

- p. 25. *Cirriphyllum cirrosum coloradense* at Kaniak Butte, Whitman Co., Washington, (Geo. N. Jones).
- p. 29, line 1. *Brachythecium* was published in fasc. 52-54 of the Bry. Eur. *Brachythecium glareosum* does not appear in the key. It will key out to 13. It is a larger species with more plicate leaves than the other species under that number.
- p. 32. Jennings, Mosses W. Pennsylvania pl. 50, has a good illustration of *Brachythecium flexicaule*.
- p. 38, line 10 from bottom, read *B. mirabundum*, also 199 for 194.
- p. 39, line 31, for 1926, read 1896.
- p. 41, line 20 from the bottom read C. V. Piper. Also after *Brachythecium rivulare* insert as synonym *Hypnum vagans* Drumm. Musc. Am. 166 (Specimen in the Canadian National Museum studied).
- p. 43. The description of *Brachythecium plumosum* states "quadrate alar cells few." They are occasionally rather numerous.
- p. 45, 18th line from bottom, read H. N. Dixon.
- p. 48. *Brachythecium collinum* has been collected at East Rainy Butte, N. Dakota and El Paso, Texas.
- p. 51 before "SCLEROPodium" insert
Brachythecium laxirete Kindb. Rev. Bryol. 36: 97. 1909. apparently only an unimportant form of *B. rutabulum*.
- Brachythecium papillipes* Kindb. l. c. Doubtful, possibly a depauperate form of *B. rutabulum* with leaves more decurrent than usual.
- Brachythecium pseudo-chlopterum* Kindb. Ottawa Nat. 23: 839. 1909. Almost certainly a form of *B. reflexum*. Described as "diecious" but non-fruitlet plants will scarcely determine this accurately in the hands of a Kindberg.
- No specimens of these 3 species (?) have been seen by the author.
- p. 56. For *Camptothecium lutescens* (Huds.) Br. & Sch., read *C. lutescens* (Hedw.) Br. & Sch. and add *Hypnum lutescens* Hedw. Sp. Musc. 274. 1801.
- p. 59, line 1 of the Key, read *Nuttallii*, not *Nutallii*.
- p. 60, in three places near bottom of page, *hamatidens* Kindb. is misspelled.
- Description of Pl. 4, read *Eurhynchium Rappii*, not *Rapii*.
- Description of Pl. 8, read in line 1, B, not C.
- Description of Pl. 10, fifth line, read *subasperrimum*, not *supasperrimum*.
- Description of Pl. 14, read *Homalothecium nevadense*, instead of *C. Nevadaense*.
- p. 74, line 20, read forma *BREVIFOLIUM* Boulay, Musc. Fr. 73. 1884. This is not the var. *brevifolium* of R. & C. Bot. Gaz. 30: 22. 1900. The latter seems to be an unimportant variation. In line 23 in parenthesis read (see Fig. 175, M.H.M.).
- p. 77. Add at bottom of page.
 Var. *IRRIGATUM* (Zett.) Broth.
Hypnum irrigatum Zett. Musc. Pyren. in K. Svenska Vet.-Akad. Handl. 5: (no. 10) p. 48. 1865.
Hypnum Vallis-Clausae Brid. Sp. Musc. 2: 238.
- Very robust, 12-20 cm. high, dark- or brownish-green; stems irregularly divided, sparingly branched; stem leaves straight or falcate, little excavate at base, scarcely concave, ovate-lanceolate, gradually acuminate, plicate, nearly entire; costa stout, excurrent or fused with the apex.
- This is to *C. commutatum* what var. *spinifolium* is to *Hygroamblystegium irriguum*. It is distinguished from the latter by the abundant paraphyllia and plicate leaves. Mt. Timpanogos, Utah, alt. 6500 ft. (Seville Flowers).
- p. 77. Third line at top of page, read var. *ACICULINUM* (C. M. & Kindb.) n. comb.
Hypnum filicinum var. *aciculinum* C. M. & Kindb. Cat. Can. Pl. 6: 241. 1892.
- p. 78. *Cratoneuron papillosum* was already published for another species from Japan—*C. papillosum* Warnst. Hedwigia 57: 123. 1915. Loeske first called my attention to this. For *C. papillosum* Grout substitute *Cratoneuron Williamsii* nomen nov. in honor of R. S. Williams, who has so often assisted me.
- p. 85. The full citation for *Hypnum pseudocomplexum* Kindb. is Rev. Bryol. 22: 85. 1895.
- p. 89. The type of *Hygrohypnum pseudomontanum* Kindb. has been seen. Another specimen from Newfoundland was found in the Kindberg herbarium.
- p. 93. Under *Hygrohypnum dilatatum* add, a specimen from Steven's Pass region, Cascade Mountains, Washington, on rock, Coll. J. M. Grant, August, 1929, has been identified by Loeske as *H. alpinum*.

(Schimp.) Loeske. It has no cilia in the peristome and is rather softer than usual, otherwise it seems good *H. dilatatum*.

- p. 100. Other synonyms of *Calliergon turgescens* are *C. lonchopus* Kindb. Rev. Bryol. 32: 37. 1895. *C. suburgescens* Kindb. Ottawa Nat. 23: 137. 1909.

Types seen in both cases. The latter is a form with the costa lacking or nearly so.

- p. 102, line before the key, read *cuspidata* for *cuspidatum*.

- p. 129. *Hypnum arcuatum* Lindb. is antedated by *Hypnum arcuatum* Hedw. Sp. Musc. 245. pl. 62. 1801, later known as *Hyphodendrum arcuatum* (Hedw.) Mitt., from Australia. Our plant should accordingly retain the name *HYPNUM PATIENTIAE* Lindb.

- p. 145. In first line of "4" in the key read *Selwynii* for *Schimperi*.

- p. 153, lines 7, 8 and 9 from the top, read *V. vesicularis* for *V. vesiculare* and *vesicularia*.

- p. 157, line 25, read Dixon & Jam., Handb. Brit. Mosses (Ed. 1) 436. 1896 in place of n. comb.

- p. 163, line ten from the bottom, read gemmiform, for gemmiform.

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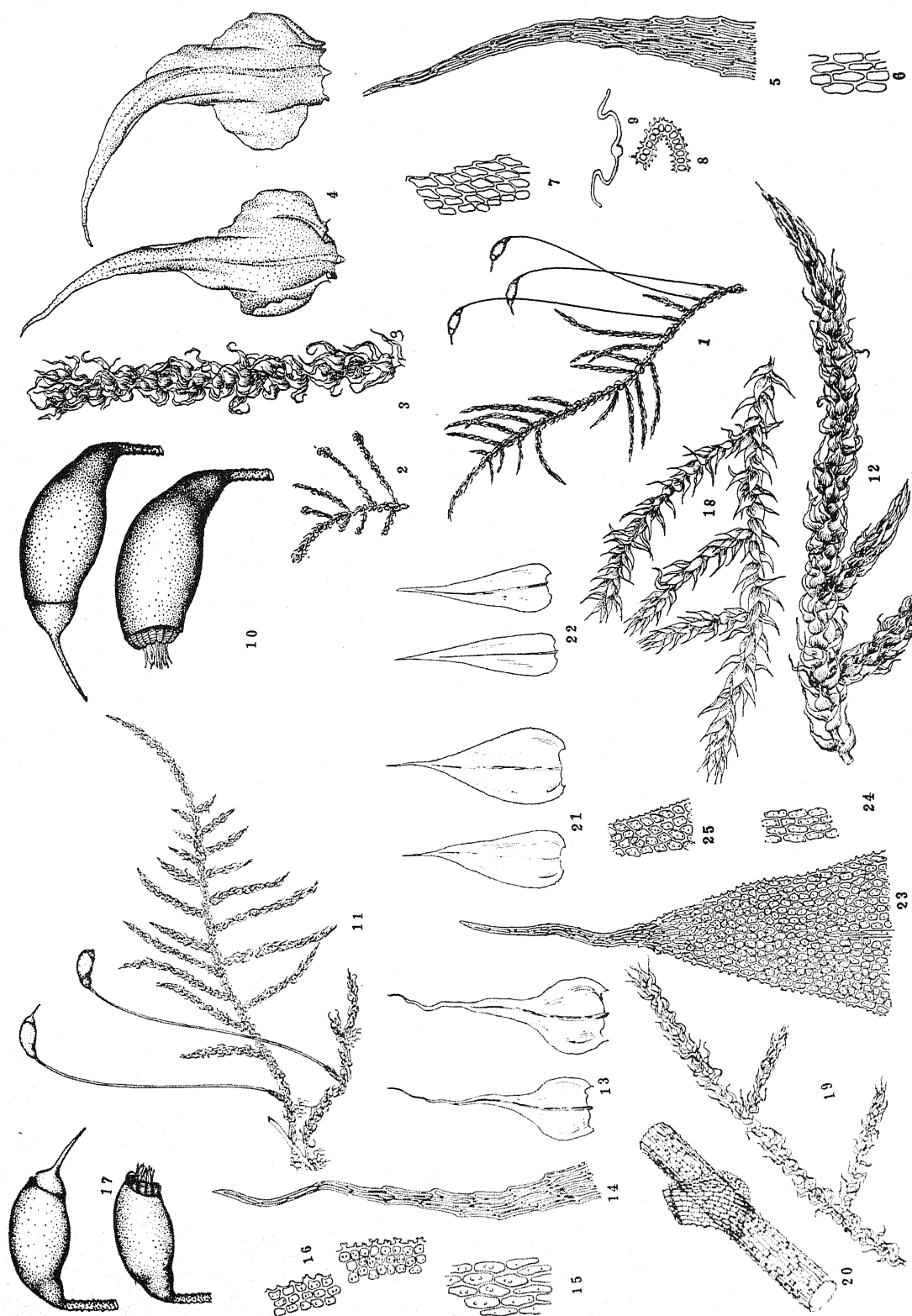


PLATE XLV.

PLATE 45. Figures 1-10. *Claopodium crispifolium*. 1, moist $\times 1$; 2, portion of same, dry; 3, portion of stem, dry $\times 5$; 4, leaves $\times 30$; 5, apex of leaf $\times 150$; 6, basal cells $\times 150$; 7, median marginal cells $\times 150$; 8, portion of cross section of leaf showing papillae $\times 150$; 9, outline of cross section of leaf base $\times 20$; 10, capsules $\times 10$.

Figures 11-17. *Claopodium Bolanderi*. 11, dry $\times 2$; 12, portion of same $\times 5$; 13, stem leaves $\times 20$; 14, leaf apex $\times 150$; 15, basal cells $\times 150$; 16, median marginal cells $\times 150$; 17, capsules $\times 10$.

Figures 18-25. *Claopodium pellucinerve*. 18, portion of plant, moist $\times 8$; 19, same dry $\times 8$; 20, portion of stem $\times 20$, showing papillae; 21, stem leaves $\times 30$; 22, branch leaves $\times 30$; 23, leaf apex $\times 150$; 24, basal cells $\times 150$; 25, median marginal cells $\times 150$. (Drawings by Seville Flowers.)



PLATE 46. A. *Claopodium Whippleanum leuconeurum* (from Sull. Icones Musc. Suppl. pl. 80). 3, portion of branch much magnified; 11 and 12, apex and base of leaf respectively, showing cells.

B. *Claopodium Whippleanum* (from Sull. Pacific R. R. Reports 4: pl. 9). 3, fertile plant much magnified; 5, portion of branch; 6, leaves; 14, perichaetial leaf (see Dr. Best's remarks, Bull. Torr. Bot. Club 27: 29 & 30). These drawings represent the type fairly well (co-type seen), but as a rule the leaves have a much longer and more slender acumination, much like the figure of the perichaetial leaf.

C. *Myurella squarrosa*. 1, plant $\times 1$; 2, portion of plant $\times 10$; 3, four leaves $\times 20$; 4, 5, 6, basal, median-marginal and central-median leaf cells respectively $\times 300$; 7, capsule $\times 10$; 8, apical cells $\times 300$. (By Seville Flowers.)

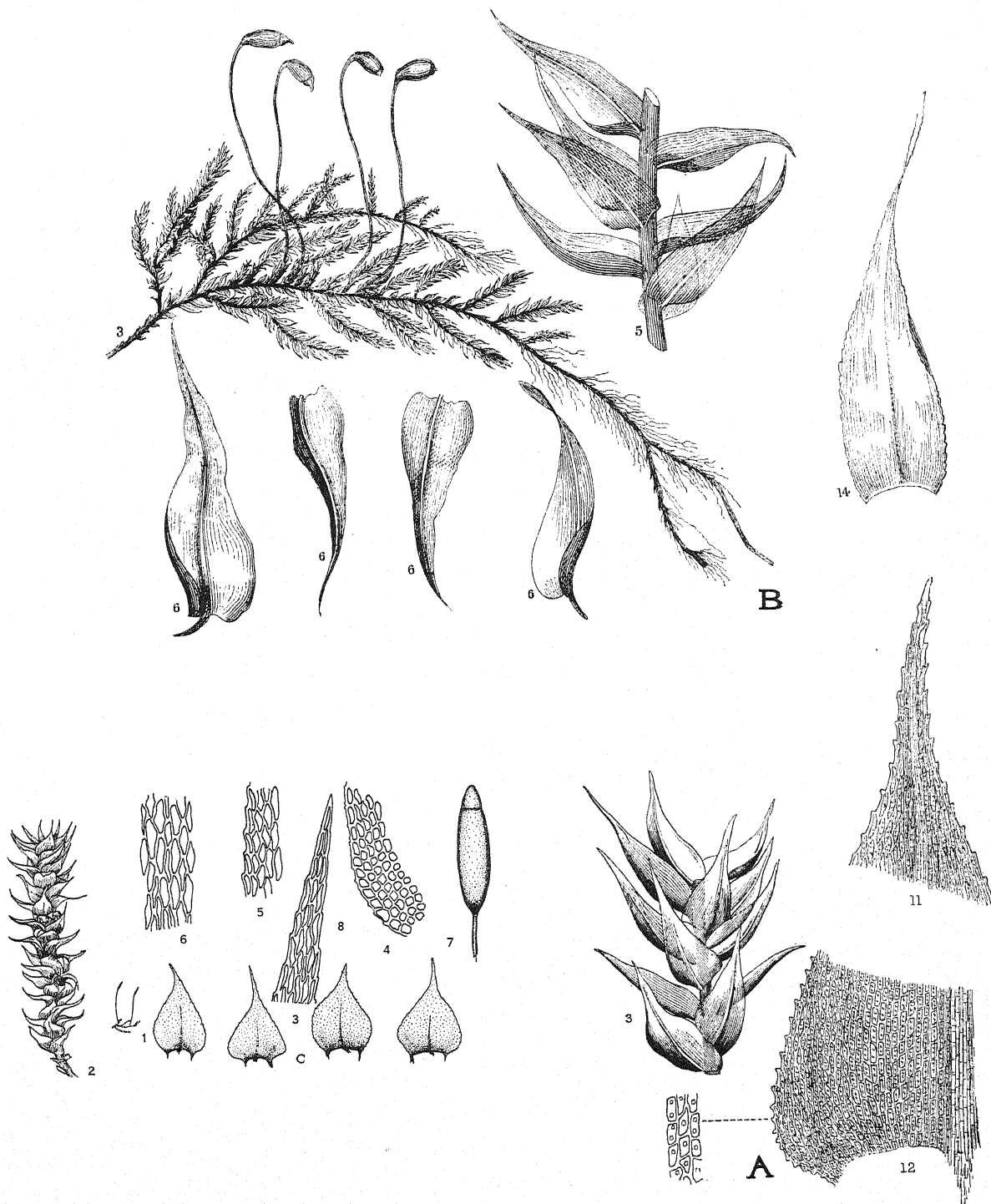


PLATE XLVI.

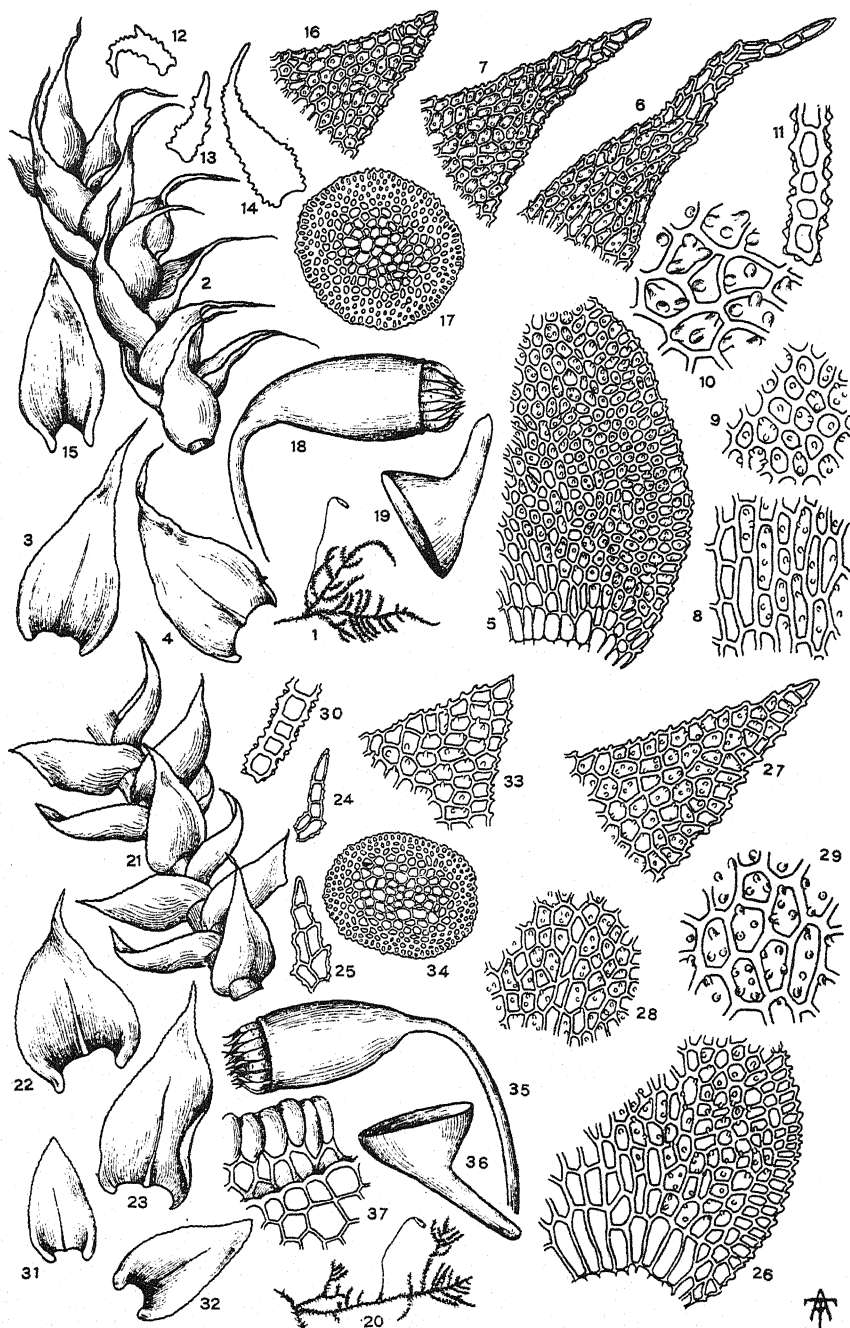


PLATE XLVII.

PLATE 47. (From Bull. Torr. Club. 28: pl. 14). *Heterocladium Macounii*; 1, plant, natural size; 2, portion of secondary stem showing arrangement of leaves $\times 18\frac{1}{2}$; 3, 4, outlines of secondary stem leaves $\times 25$; 5, basal portion of secondary stem leaf $\times 120$; 6, apex of same $\times 120$; 7, apex of some of the secondary stem leaves $\times 120$; 8, central cells from secondary stem leaf $\times 210$; 9, marginal cells from same $\times 210$; 10, marginal cells showing papillae $\times 500$; 11, cross-section of secondary stem leaf showing papillae $\times 270$; 12, 13, 14, paraphyllia $\times 57\frac{1}{2}$; 15, outline of ultimate branch leaf $\times 35$; 16, apex of ultimate branch leaf $\times 120$; 17, cross-section of stem $\times 57\frac{1}{2}$; 18, capsule $\times 8$; 19, operculum $\times 15$.

Heterocladium heteropteroides; 20, plant, natural size; 21, portion of stem showing arrangement of leaves $\times 18\frac{1}{2}$; 22, 23, outlines of stem leaves $\times 25$; 24, 25, paraphyllia $\times 162\frac{1}{2}$; 26, basal portion of stem leaf $\times 210$; 27, apex of same $\times 210$; 28, central cells from stem leaf $\times 210$; 29, marginal cells showing papillae $\times 500$; 30 cross-section of stem leaf showing papillae $\times 270$; 31, 32, outlines of ultimate branch leaf $\times 45$; 33, apex of ultimate branch leaf $\times 210$; 34, cross-section of stem $\times 57\frac{1}{2}$; 35, capsule $\times 8$; 36, operculum $\times 11\frac{1}{2}$; 37, portion of annulus and capsule $\times 120$.

PLATE 48. (From Bull. Torr. Club. 28: pl. 13). *Heterocladium procurrens*; 1, plant, natural size; 2, portion of stem showing arrangement of leaves $\times 11\frac{1}{2}$; 3, 4, 5, outlines of stem leaves $\times 11\frac{1}{2}$; 6, basal portion of stem leaf $\times 87\frac{1}{2}$; 7, cells from middle portion of stem leaf $\times 87\frac{1}{2}$; 8, cells from center of stem leaf, showing the two veins the walls of which are shaded $\times 120$; 9, apex of stem leaf $\times 87\frac{1}{2}$; 10, paraphyllium $\times 57\frac{1}{2}$; 11, paraphyllium showing width of walls $\times 87\frac{1}{2}$; 12, ultimate branch showing arrangement of leaves $\times 11\frac{1}{2}$; 13, leaf from ultimate branch $\times 15$; 14, basal portion of branch leaf $\times 87\frac{1}{2}$; 15, apex of same $\times 87\frac{1}{2}$; 16, capsule, dry $\times 8$; 17, operculum $\times 8$.

Heterocladium squarrosulum; 18, plant, natural size; 19, portion of primary stem showing arrangement of leaves $\times 18\frac{1}{2}$; 20, 21, outlines of primary stem leaves $\times 18\frac{1}{2}$; 22, basal portion of primary stem leaf $\times 120$; 23, apex of same $\times 120$; 24, central cells from primary stem leaf $\times 207\frac{1}{2}$; 25, marginal cells from the same $\times 207\frac{1}{2}$; 26, paraphyllium showing cells $\times 87\frac{1}{2}$; 27, 28, paraphyllia $\times 45$; 29, 30, outlines of secondary stem leaves $\times 18\frac{1}{2}$; 31, apex of secondary stem leaf $\times 120$; 32, cross-section of secondary stem leaf showing papillae $\times 270$; 33, portion of ultimate branch showing arrangement of leaves when moist $\times 18\frac{1}{2}$; 34, portion of ultimate branch showing arrangement of leaves when dry $\times 18\frac{1}{2}$; 35, 36, 37, outlines of ultimate branch leaves $\times 25$; 38, oblique view of ultimate branch leaf showing papillae $\times 87\frac{1}{2}$; 39, apex of ultimate branch leaf $\times 120$; 40, operculum $\times 15$.

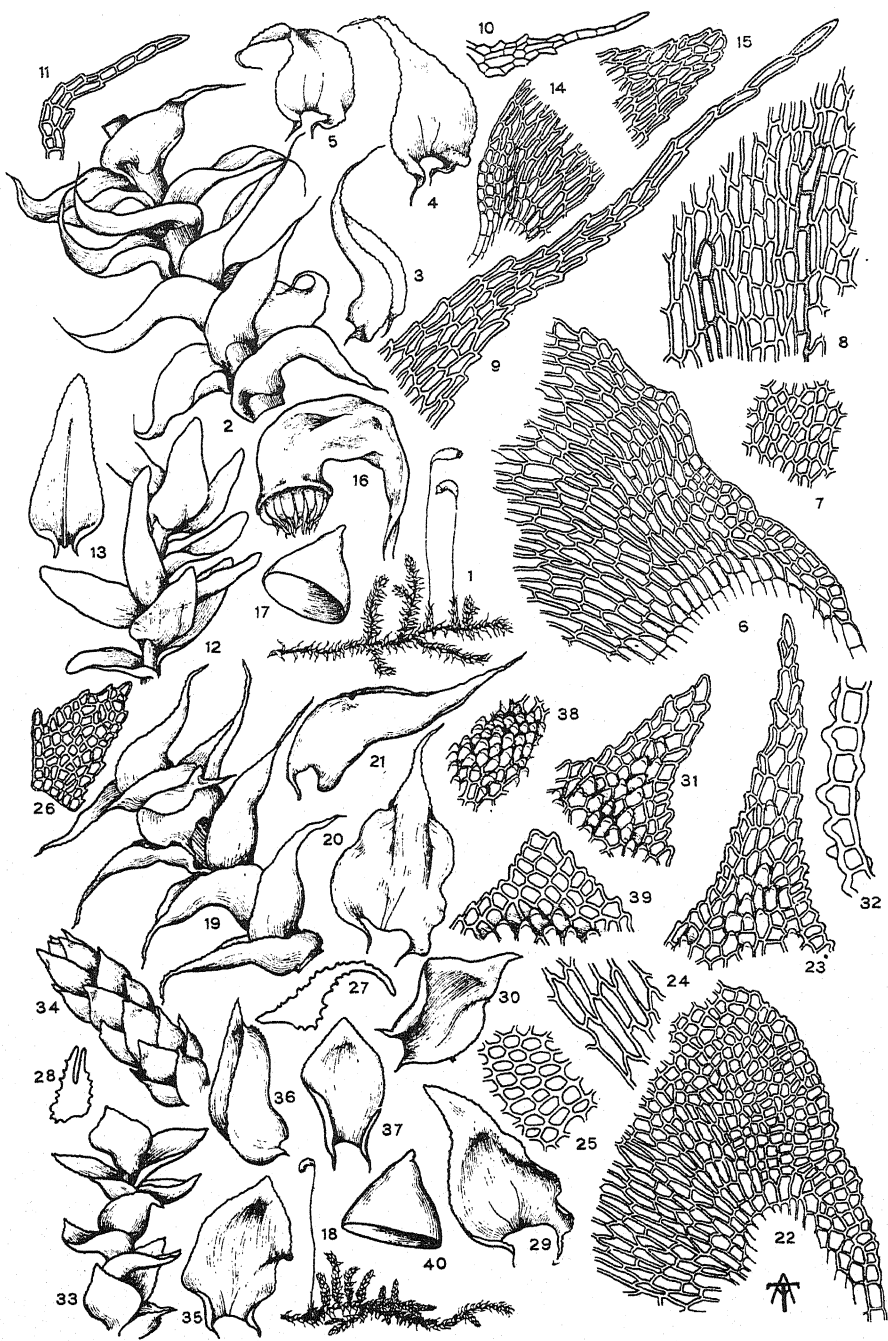


PLATE XLVIII.

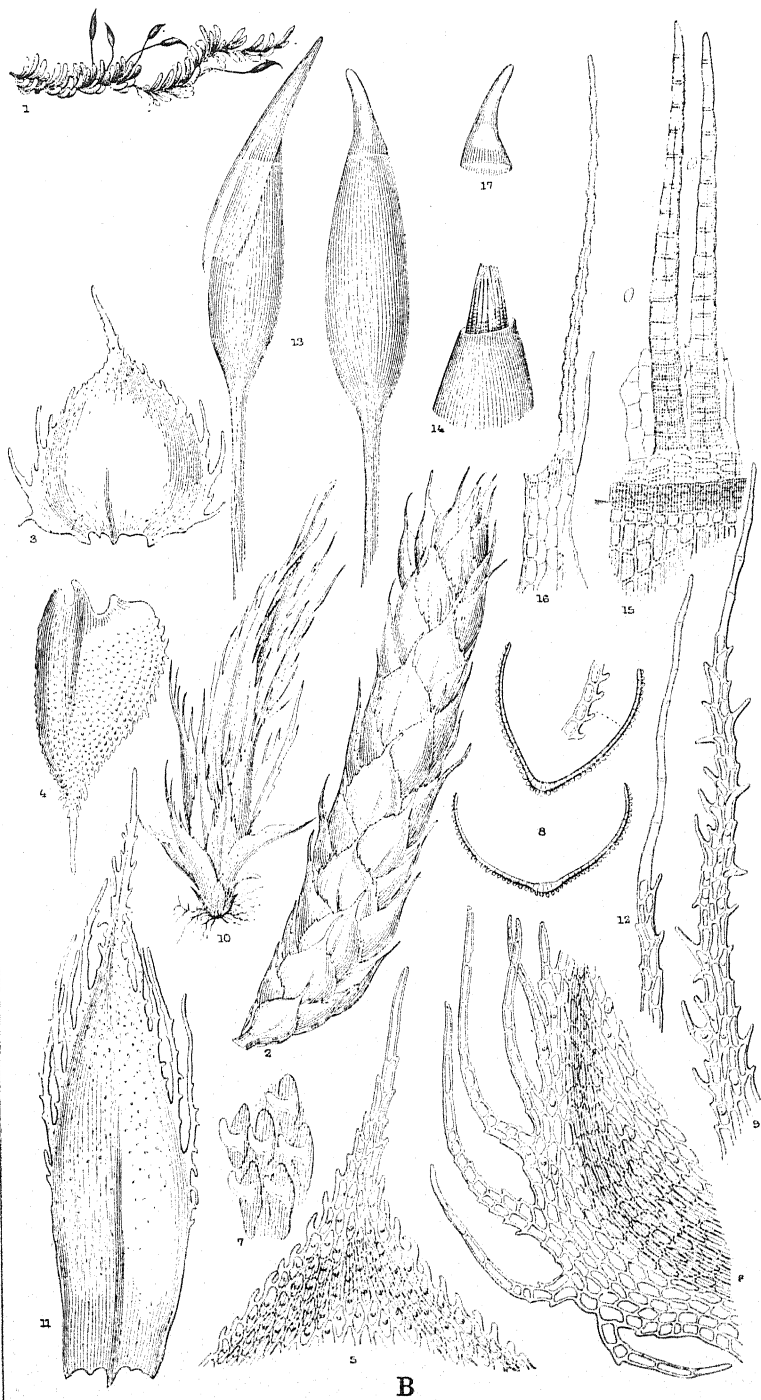
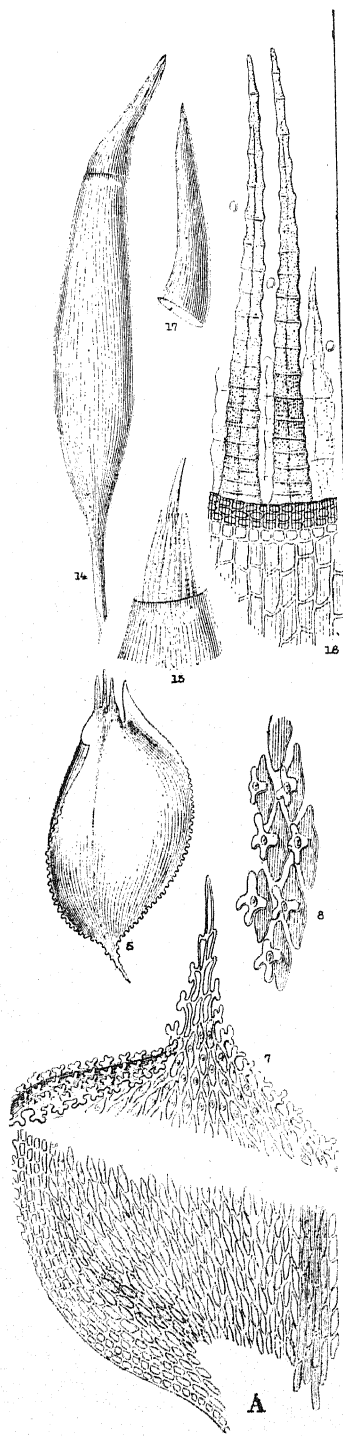


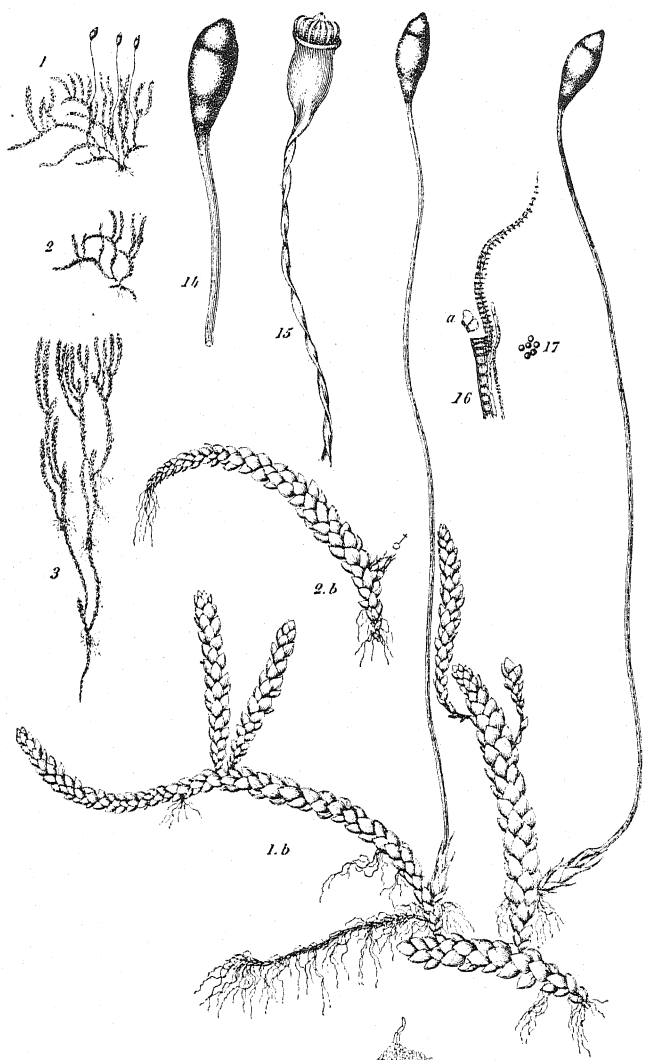
PLATE XLIX.

PLATE 49. A. *Thelia Lescurii* (from Sull. Icones Musc. pl. 82). 5, leaf; 6, 7, base and apex of leaf showing cells; 8, a few cells showing papillae; 14, capsule; 15, 18, peristome; 17, operculum.

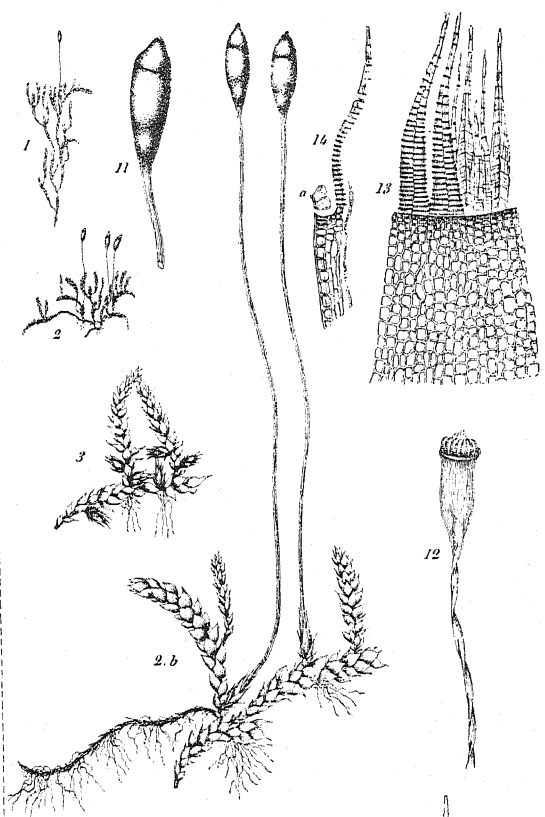
B. *Thelia hirtella* (from Sull. l. c. pl. 80). 1, plant $\times 1$; 2, branch; 3, 4, branch leaves; 5, 6, apical and basal cells; 7, five cells showing papillae; 8, cross sections of leaf; 9, apex of perichaetial leaf; 10, perichaetium; 11, perichaetial leaf; 12, marginal cilium of leaf; 13, capsules; 14, 15, 16, peristome; 17, operculum.

PLATE 50. (From Bry. Eur. pl. 560). *Myurella juacea*. 1, 2, creeping plants; 3, plant from a dense tuft; 1b, 2b, portions of plant much magnified; 4-7, leaves; 7ab, leaf showing areolation; 8, 8a, rare apiculate leaves; 14, 15, capsules; 16, peristome and annulus in longitudinal section.

Myurella apiculata (tenerrima). 1, 2, plants; 2b, 3, portions of plants more enlarged; 4, 5, leaves; 5 ab, leaf showing areolation; 6, perigonal leaf and antheridium; 7, 8, 9, perichaetial leaves; 11, 12, capsules; 13, part of peristome; 14, portion of peristome and annulus in longitudinal section.



julacea



apiculata

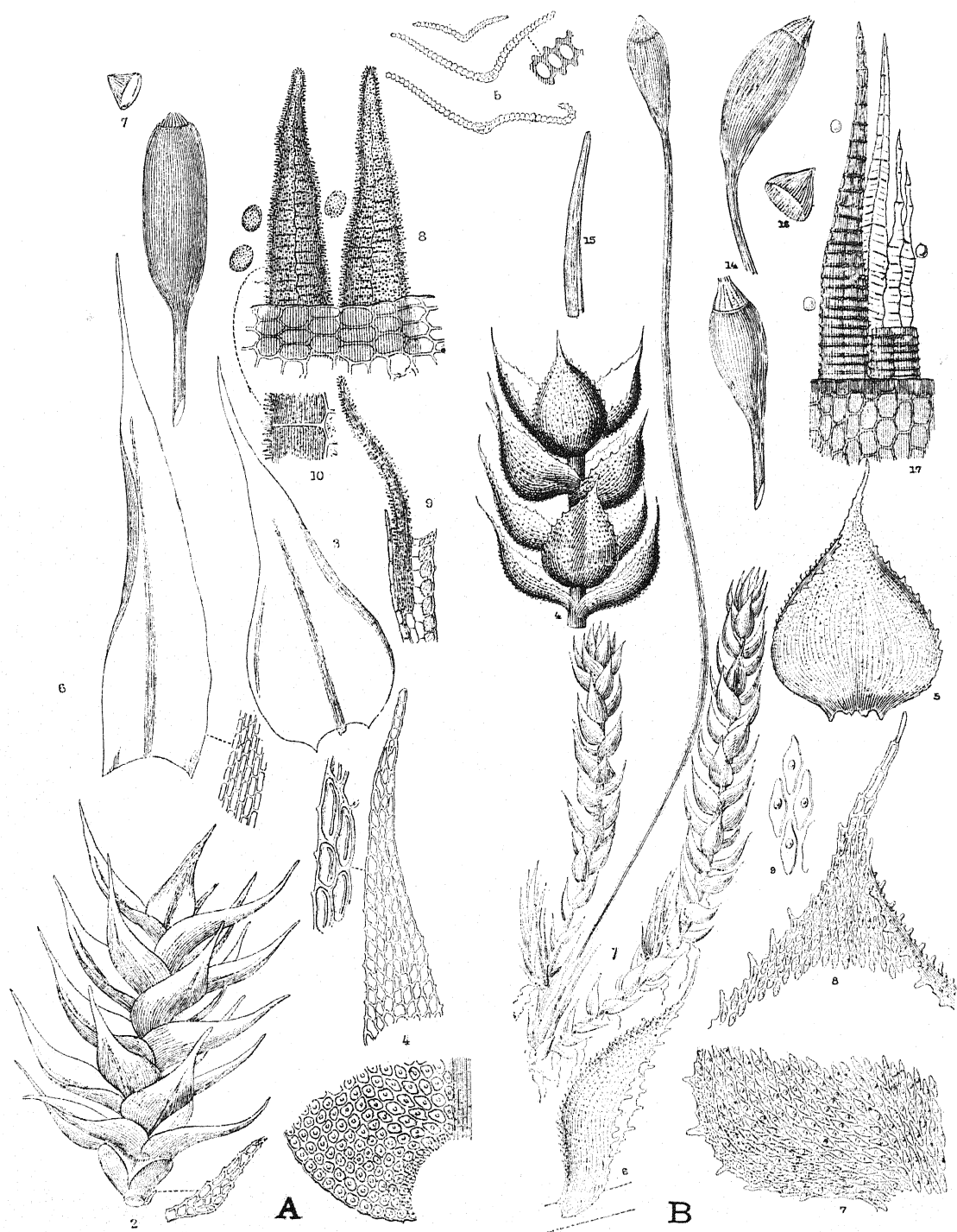


PLATE LI.

PLATE 51. A. *Lindbergia Austinii* (from Sull. Icones Musc. Suppl. pl. 61). 2, portion of branch showing leaves and paraphyllum; 3, leaf; 4, leaf cells of base and apex; 5, cross sections of leaf; 6, perichaetial leaf; 7, capsule and operculum; 8, 9, 10, peristome and spores.

B. *Myurella Careyana* (from Sull. Icones Musc. pl. 83). 1, fertile plant much magnified; 4, part of a branch; 5, 6, branch leaves; 7, 8, leaf base and apex showing cells; 9, four cells showing papillae; 14, capsules; 15, calyptra; 16, operculum; 17, peristome.

PLATE 52. (From Bull. Torr. Bot. Club 30: plates 15 & 16).

Leskea microcarpa

- | | |
|--|--|
| 28. Plant, natural size. | 35. Cross-section of stem. $\times 235$. |
| 29. Outline of stem-leaf. $\times 44$. | 36. Perichetial bud. $\times 7\frac{1}{2}$. |
| 30, 31, 32. Outlines of branch-leaves. $\times 44$. | 37. Inner perichetial bract. $\times 18$. |
| 33. Apex of stem-leaf. $\times 170$. | 38. Capsule. $\times 9$. |
| 34. Median cells of leaf. $\times 390$. | 39. Peristome (annulus for the most part of one row). $\times 100$. |

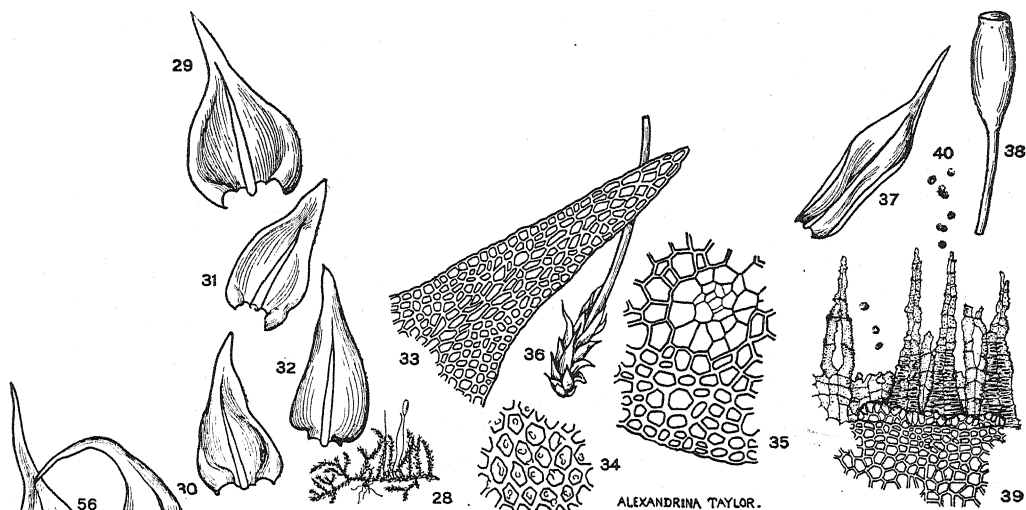
40. Spores. $\times 100$.

Leskea Williamsi

- | | |
|--|---|
| 55. Plant, natural size. | 63. Cross-section of stem. $\times 130$. |
| 56, 57. Outlines of stem-leaves. $\times 44$. | 65. Perichetial leaf. $\times 20$. |
| 58, 59, 60. Outlines of branch-leaves. $\times 44$. | 66. Capsule. $\times 15\frac{1}{2}$. |
| 61. Apex of stem-leaf. $\times 130$. | 67. Peristome. $\times 130$. |
| 62. Median cells of leaf. $\times 310$. | 68. Spores. $\times 130$. |

Leskea tectorum

- | | |
|---|---|
| 69. Plant, natural size. | 73. Apex of stem-leaf. $\times 130$. |
| 70. Outline of a portion of stem. $\times 20$. | 74. Median cells of leaf. $\times 310$. |
| 71. Outline of stem-leaf. $\times 44$. | 75. Cross-section of leaf. $\times 130$. |
| 72. Outline of branch-leaf. $\times 44$. | 76. Cross-section of stem. $\times 130$. |



28-40. *L. MICROCARPA*.



LESKEA

55-68. *L. WILLIAMSII*.

69-76. *L. TECTORUM*.

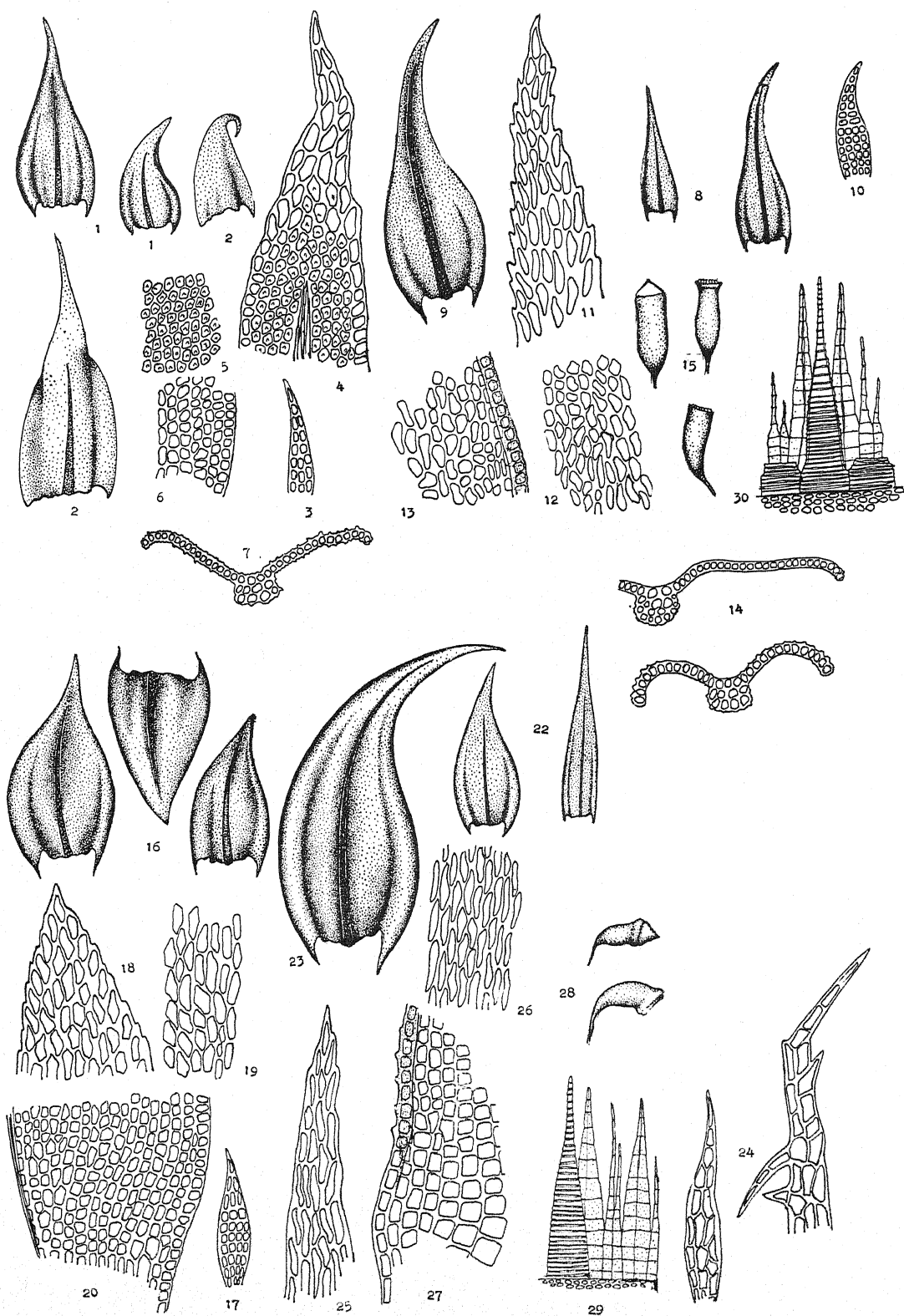


PLATE LIII.

PLATE 53. (From Bull. Torr. Bot. Club. 27: plates 6 and 7). *Pseudoleskea atrovirens*; 1, upper and lower leaves; 2, outer and inner perichetial leaves; 3, paraphyllium; 4, apex of leaf; 5, median cell; 6, alar cells; 7, cross-section.

Pseudoleskea oligoclada; 8, branch leaves; 9, stem leaf; 10, paraphyllium; 11, apex of leaf; 12, median cells; 13, alar cells; 14, cross-sections of leaf; 15, capsules; 25, capsule with lid; 30, peristome.

Pseudoleskea pallida; 16, stem leaves; 17, paraphyllium; 18, apex of leaf; 19, median cells; 20, alar cells.

Pseudoleskea denudata; 22, branch leaves; 23, stem leaf; 24, simple and divided paraphyllia; 25, apex of leaf; 26, median cells; 27, alar cells; *Var. Holzingeri*; 28, horizontal and arcuate capsules; 29, peristome.

PLATE 54. (From Bull. Torr. Bot. Club. 27: l. c.). *Pseudoleskea radicata*; 1, branch leaf; 2, stem leaf; 3, perichaetial leaf; 4, apex of leaf; 5, median cells; 6, alar cells; 7, cross-section of leaf; 8, back of costa near apex; 9, paraphyllium; 30, two curved capsules, with and without lid; 31, peristome with oblong-lanceolate segments.

Pseudoleskea rigescens; 10, stems leaves; 11, perichetial leaf; 12, paraphyllium; 13, apex of leaf; 14, median cells; 15, alar cells; 16, cross-section; 32, two straight capsules, with and without lid; 33, peristome with linear segments.

Pseudoleskea substriata; 17, branch leaf; 18, stem leaves; 19, paraphyllium; 20, apex of leaf; 21, median cells; 22, basal half of leaf; 23, cross-section; 24, back of costa near the apex.

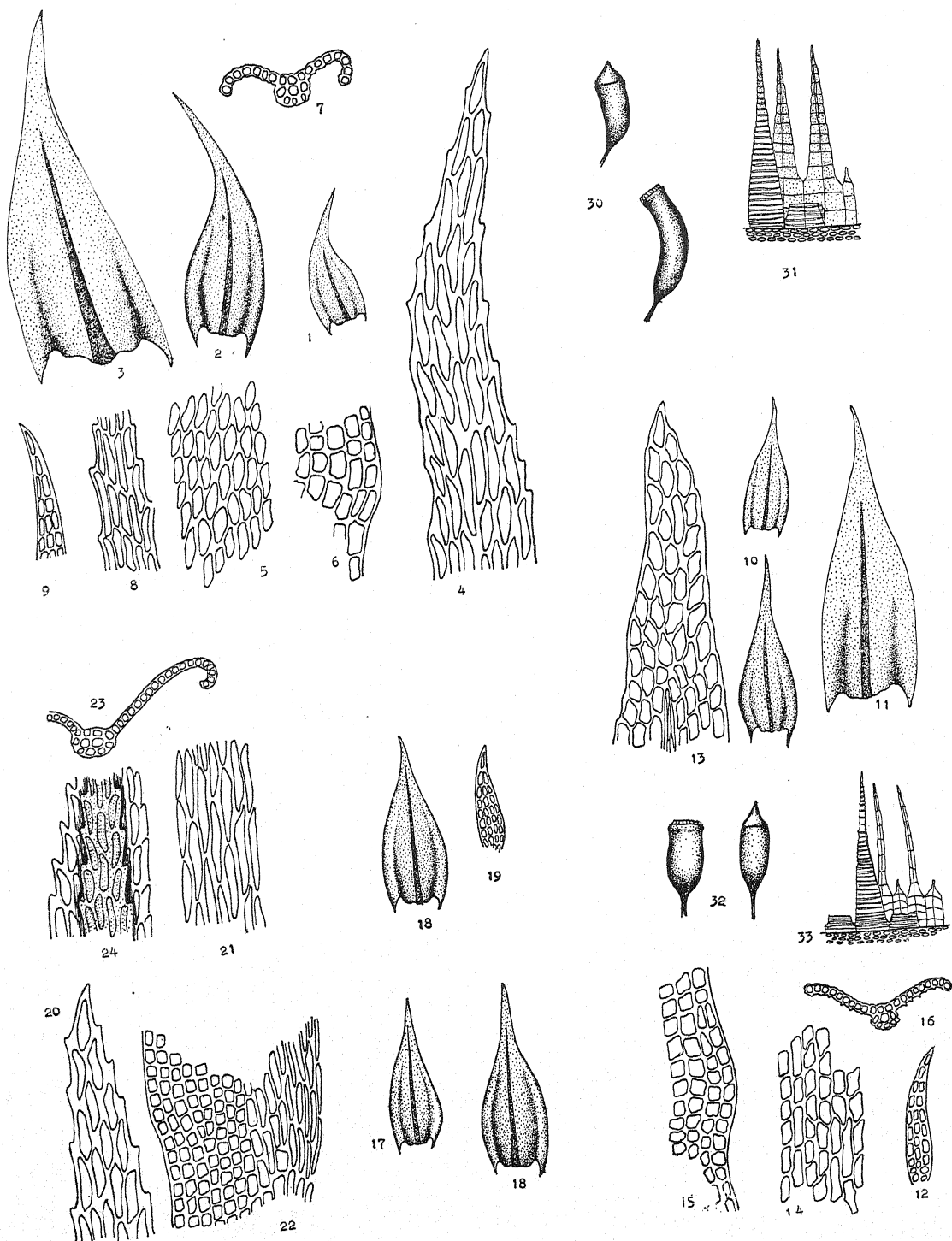


PLATE LIV

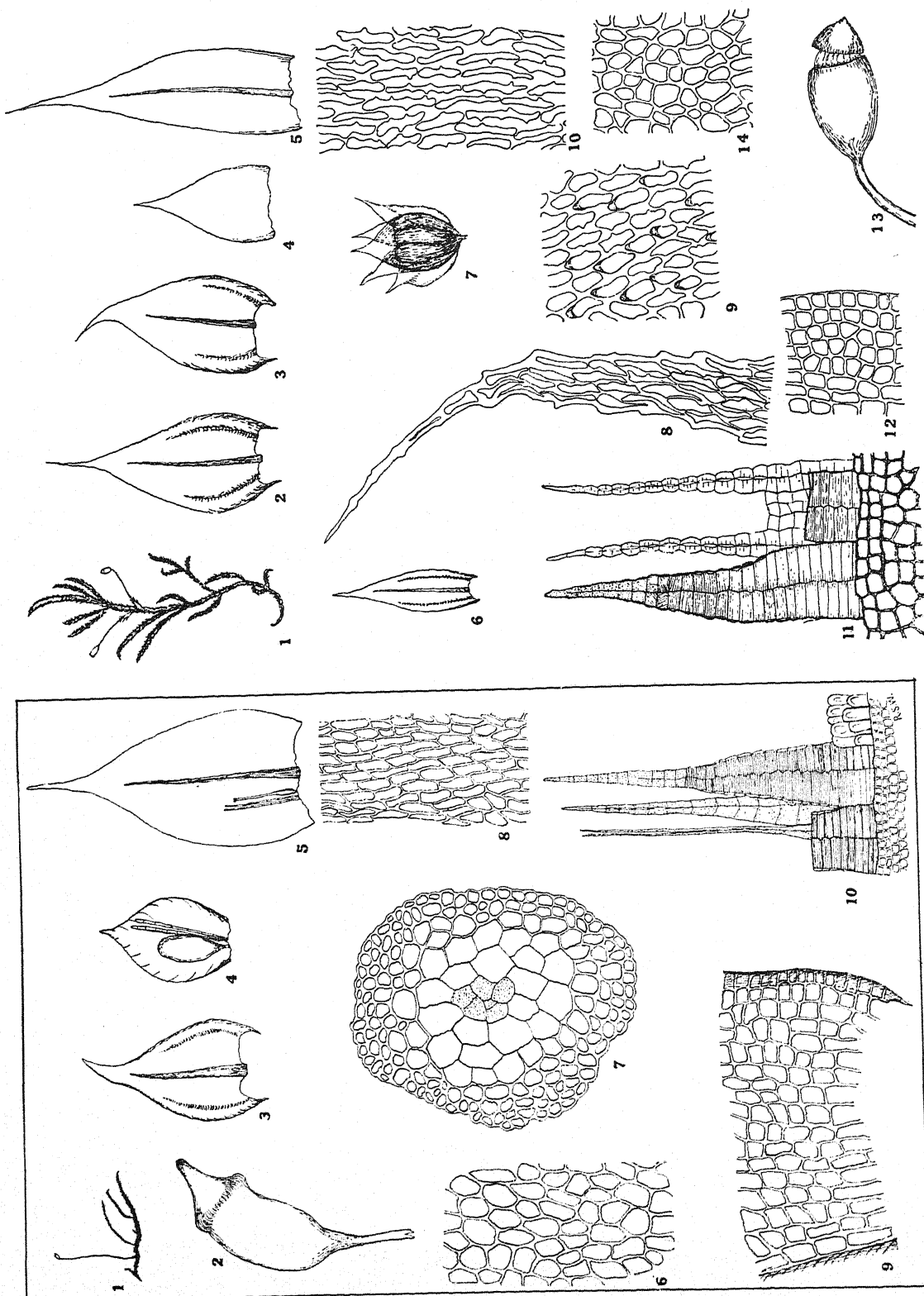


PLATE LV.

PLATE 55. Right. *Pseudoleskea arizonae* (from Bryologist, 33: pl. 3). 1, plants about $\times 1$; 2, capsule $\times 20$; 3, stem leaf $\times 40$; 4, perigonal leaf $\times 40$; 5, perichaetial leaf $\times 40$; 6, median exothelial cells $\times 300$; 7, cross section of stem $\times 300$; 8, median leaf cells $\times 300$; 9, basal cells of stem leaf $\times 300$; 10, part of peristome $\times 30$.

Left. *Pseudoleskea Baileyi* (from Bryologist, 27: pl. 13). 1, plant $\times 1$; 2, 3, stem leaves $\times 20$; 4, 5, outer and inner perichaetial leaf $\times 20$; 6, branch leaf $\times 20$; 7, perigonium $\times 20$; 8, apex of stem leaf $\times 215$; 9, median leaf cells $\times 215$; 10, lower cells near costa $\times 215$; 11, part of peristome $\times 160$; 12, cells at basal leaf angle $\times 215$; 13, capsule $\times 30$; 14, median exothelial cells $\times 160$.

PLATE 56 (from Sull. Icones Musc. pl. 76). A. *Herpelineurum loccoae*. 1, female plants $\times 1$; 2, part of a secondary stem; 3, 4, leaves of the same; 5, 6, leaf cells; 7, cross sections of leaves; 8, perichaetium; 9, 10, perichaetial leaves and perigonia; 11, archegonium and paraphysis.

B. *Pirella cymbifolia*. 1, plant $\times 1$; 2, 3, parts of a branch; 4, leaf; 5, 6, basal and apical leaf cells; 7, a few cells much enlarged; 8, cross sections of leaves; 9, 10, 11, perichaetium and perichaetial leaves.



PLATE LVI.



PLATE LVII.

PLATE 57. A. *Pirella ludoviciae*. 1, secondary stem $\times 2$; 2, lower stem leaves $\times 20$; 3, median stem leaves $\times 20$; 4, upper stem leaf $\times 20$; 5, branch leaves $\times 20$.

B. *Meteoriopsis patula*. 1, portion of stem $\times 7.5$; 2, leaves $\times 20$; 3, median leaf cells $\times 300$; 4, apical cells $\times 300$.

C. *Anomodon tristis*. 1, plant $\times 5$; 2, branch $\times 20$; 3, stem leaves $\times 20$; 4, branch leaves $\times 20$; 5, lower marginal leaf cells $\times 300$; 6, median cells $\times 300$; 7, marginal cells $\times 300$.

D. *Alsia californica*. 1, portion of secondary stem $\times 2$; 2, stem leaves $\times 20$; 3, branch leaf $\times 20$; 4, apical leaf cells $\times 300$; 5, lower median cells $\times 300$; 6, basal cells near costa $\times 300$; 7, alar cells $\times 300$; 8, upper median cells $\times 300$; 9, paraphyllia $\times 300$; 10, capsule $\times 12$; 11, peristome $\times 70$ and portion of tooth $\times 300$. (Drawings by Seville Flowers.) (Figures D, 1 and D, 4 are not numbered.)

PLATE 58. A. *Callicostella scabriseta*. 1, fertile stem $\times 5$; 2, three leaves; 3, apical cells; 4, lower and upper median cells showing papillae; 5, basal cells; 6, marginal cells, roughness of margin exaggerated, all cells $\times 150$; 8, capsule with fallen lid $\times 20$; 9, calyptra in place $\times 20$; 10, peristome $\times 25$. The capsule in 1 is out of proportion, being nearly $\times 10$.

B. *Hookeria acutifolia*. 1, portion of plant $\times 1$; 2, two leaves of different size; 3, 4, apical and median leaf cells respectively $\times 75$; 7, apical portion of 1, $\times 8$.

C. *Cyclodictyon varians*. 1, plant $\times 1$; 2, leaves $\times 20$; 3, and 4, apical and median-marginal leaf cells $\times 75$; 7, apical portion of 1 $\times 8$. (All drawings on this plate by Seville Flowers.)

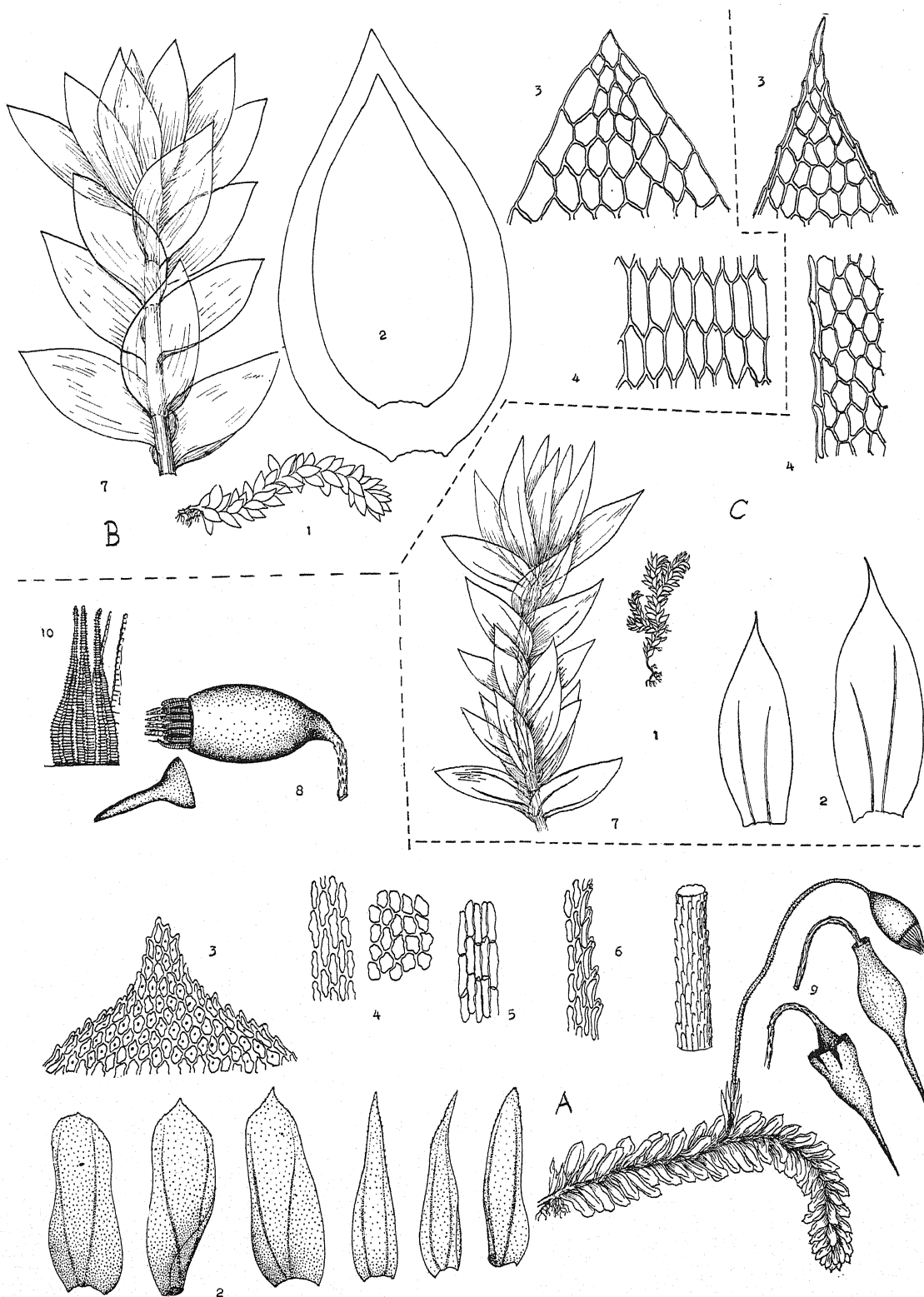


PLATE LVIII.

PLATE 59. A. *Hookeria lucens* (from Bry. Eur. *pl.* 448). 1b, branch; 5, 6, upper median leaves; 6a, apical cells; 11, perichaetial leaf; 14, 15, 16, 17, capsules; 18, 19, peristome.

B. *Myrinia pulvinata* (from Bry. Eur. l. c. *pl.* 471). 5, leaf; 5a, 5b, apical and basal leaf cells; 14, calyptra; 15, 18, capsules; 17, operculum.

PLATE 60. A. *Neckera Douglasii*; 1, portion of branch $\times 8$; 2 and 3, leaves $\times 20$; 4, 5, and 6, apical, median and basal cells respectively $\times 300$; 7, perichaetial leaves and capsule $\times 8$.

B. *Neckera disticha*; secondary stem and branches $\times 2$; 2, portion of fruiting plant $\times 5$; 3 and 4, leaves $\times 20$; 5, upper marginal cells on the plane side of leaf; 6, upper marginal cells on the incurved side of the leaf (leaf at left is a left hand leaf; 5 and 6 were from a right hand leaf); 7, sporophyte $\times 20$; 8, perichaetial leaves $\times 20$. (4 not numbered.)

C. *Neckera neo-mexicana*; 1, portion of plant $\times 1$; 2, leaves $\times 20$; 3, 4, 5, and 6, apical, upper median, lower median and median leaf cells respectively $\times 300$. (Drawings by Seville Flowers.)

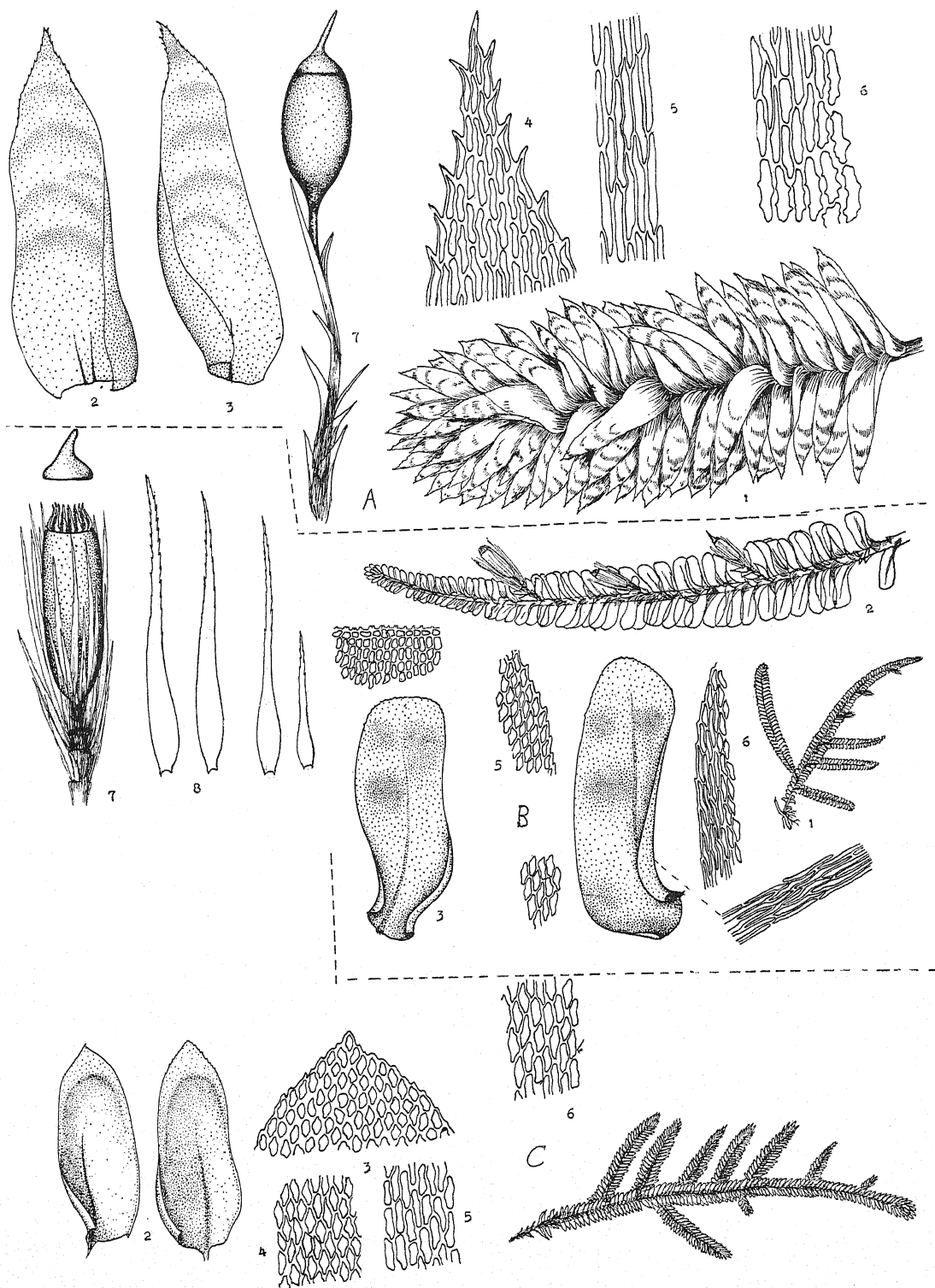


PLATE LX.

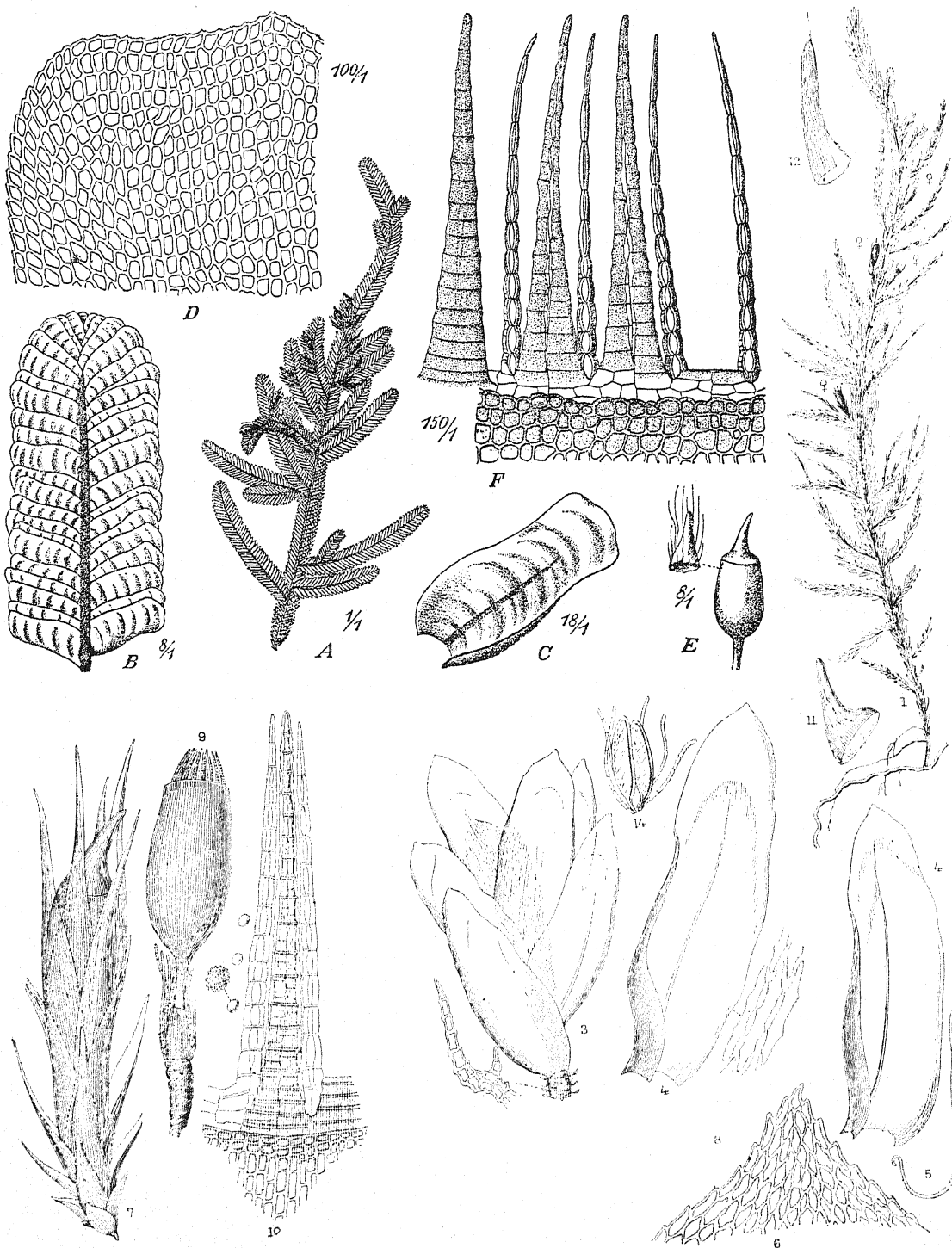


PLATE LXI.

PLATE 61. A-F. *Neckera undulata* (from Engler-Prantl, Musci (Ed. 2) f. 571). A, plant; B, portion of branch; C, leaf; D, apical leaf cells; E, capsule and calyptra; F, peristome.

1-12. *Neckera Menziesii* (from Sull. Icones Musc. Suppl. pl. 62). 1, plant $\times 1$; 3, part of a branch with leaves and paraphyllia; 4, leaves; 5, cross section of leaf; 6, apex of leaf; 7, perichaetium; 9, capsule; 10, peristome; 11, operculum; 12, calyptra.

PLATE 62. A. *Neckera gracilis* (from Sull. Icones Musc, Suppl. pl. 25). 1, plant $\times 1$; 2, part of a branch; 3, branch leaves; 4, leaves of branchlets; 5, cross section of a leaf; 6, basal and apical cells.

B. *Barbella pendula* (from Sull. Icones Musc. pl. 73). 1, plant $\times 1$; 2, part of a fertile branch; 3, part of a branch with 2 leaves; 4, 5, 6, 7, leaves; 8, basal leaf cells; 9, 10, 13, apical cells; 11, perichaetium; 12, perichaetial leaf; 14, capsule; 15, operculum; 16, calyptra; 17, part of the peristome; 18, peristome tooth in side view.



PLATE LXII.

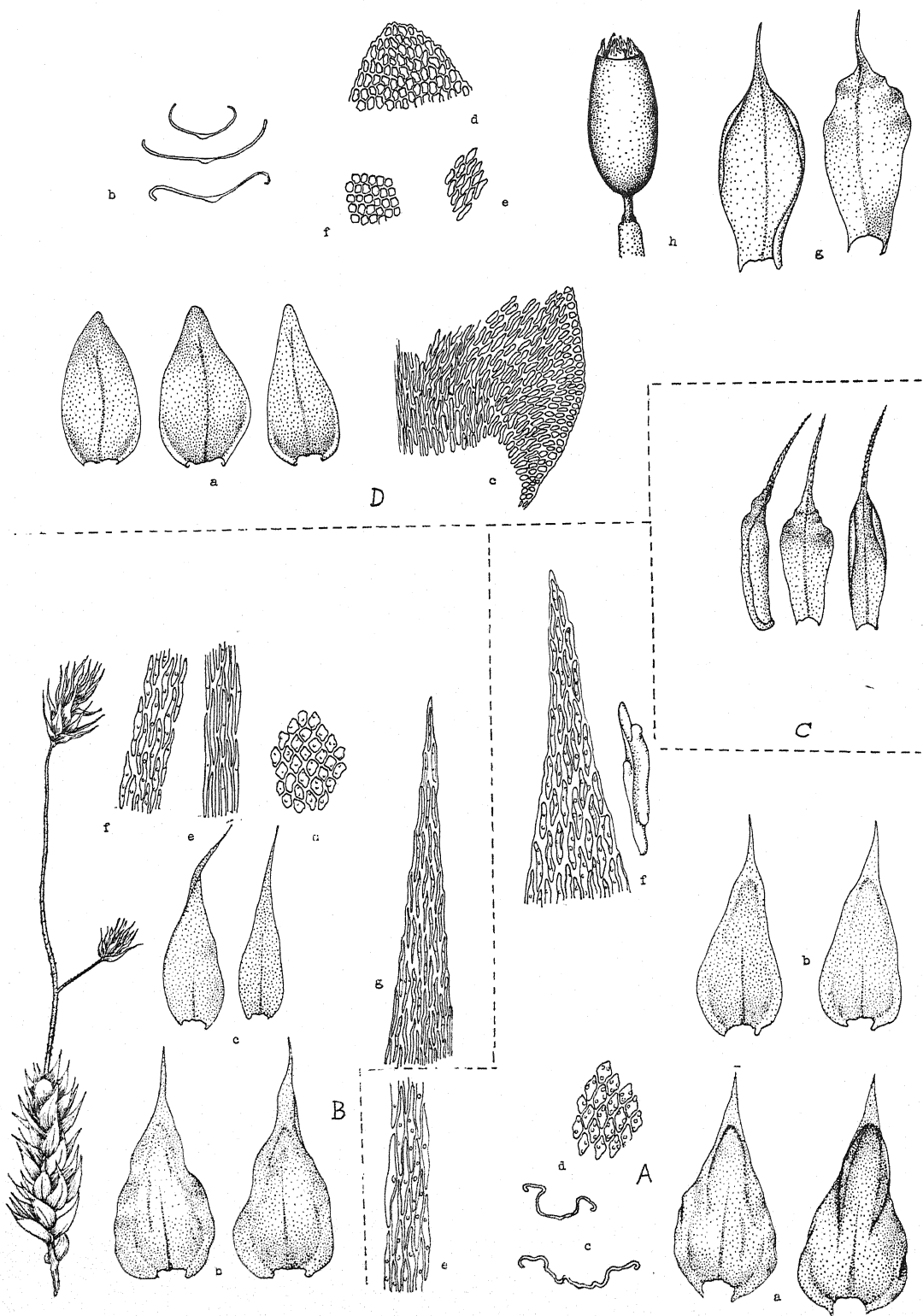


PLATE LXIII.

PLATE 63. A. *Tricholepis nigrescens*; a, leaves $\times 20$; b, upper leaves $\times 20$; c, cross-sections of leaves $\times 20$; d, alar cells $\times 300$; e, basal cells near costa $\times 300$; f, apical cells $\times 300$ and two cells $\times 1000$.

B. *T. nigrescens Donnellii*; portion of a partially denuded branch $\times 5$; b, leaves $\times 20$; c, leaves of the end tuft $\times 20$; d, alar cells $\times 300$; e, basal cells near costa $\times 300$; a, median cells $\times 300$; g, apical cells $\times 300$.

C. Three perichaetial leaves of *Cryphea glomerata scabra* $\times 10$.

D. *Cryphea Ravenelii*; a, three leaves $\times 20$; b, cross-section of leaves; c, basal areolation $\times 300$; d, apical cells $\times 300$; e, cells from the lower median half of the leaf; f, cells from the upper $\frac{1}{2}$ of leaf, both $\times 300$; g, perichaetial leaves $\times 20$; h, capsule $\times 20$. (Drawings by Seville Flowers.)

PLATE 64. A. *Antitrichia californica* (from Sull. Icones Musc. pl. 59); 1, branch of fruiting plant dry $\times 4$; 2, portion of stem, moist $\times 5$; 3, portion of male plant, dry $\times 4$; 4, stem leaves $\times 20$; 5, branch leaves $\times 20$; 6, basal areolation $\times 300$; 7, median cells $\times 300$; 8, apical cells $\times 300$; 9, antheridial bud $\times 15$; 10, perichaetium $\times 15$.

B. *Leucodontopsis floridana*; 1, plant, natural size; 2, portion of secondary stem $\times 5$, moist; 3, three stem leaves $\times 20$; 4, branch leaves $\times 20$; 5, cross section of stem leaves; 6, 7, and 8, basal, median and apical cells respectively $\times 300$. (Drawings by Seville Flowers.)

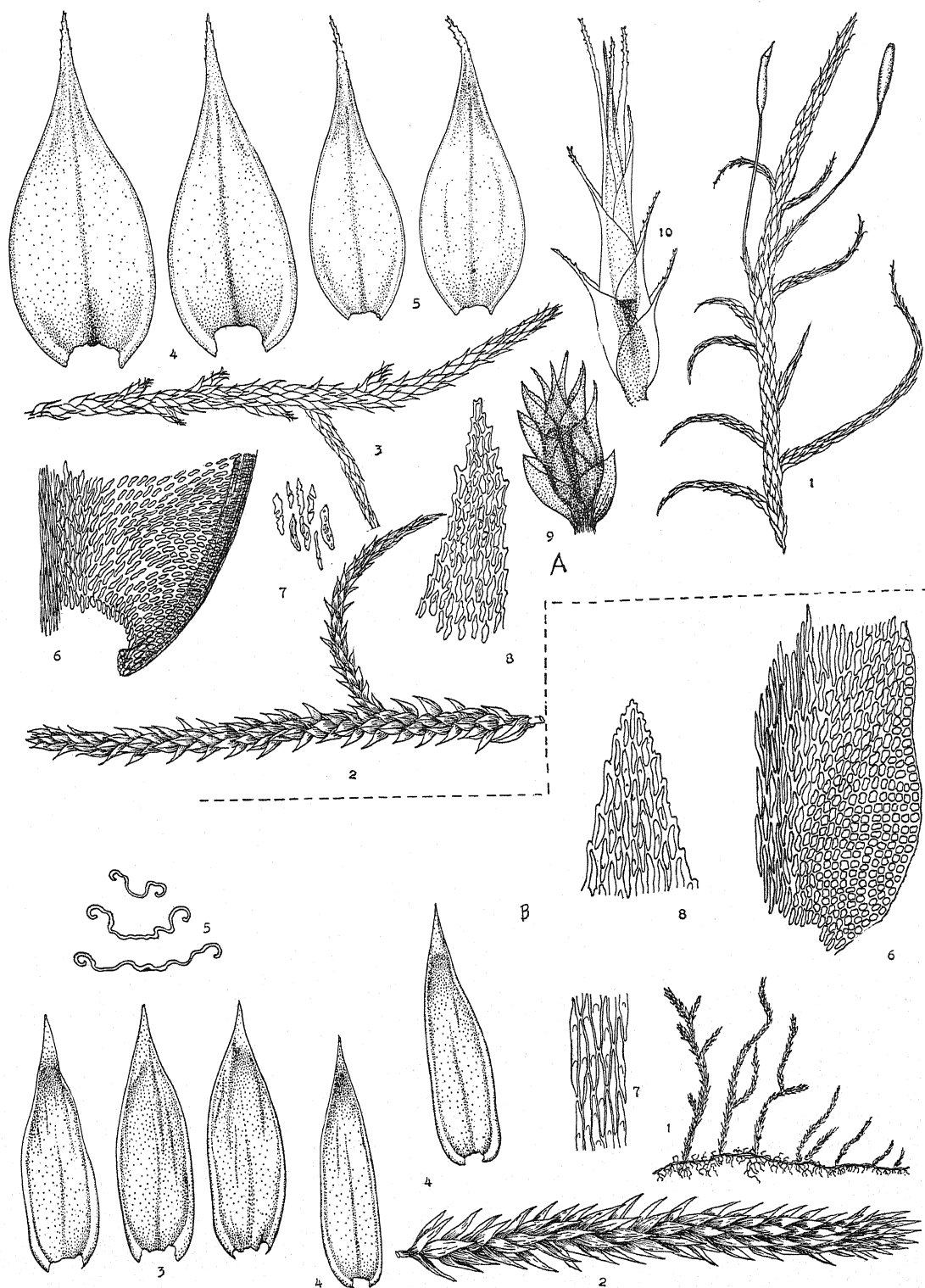


PLATE LXIV.

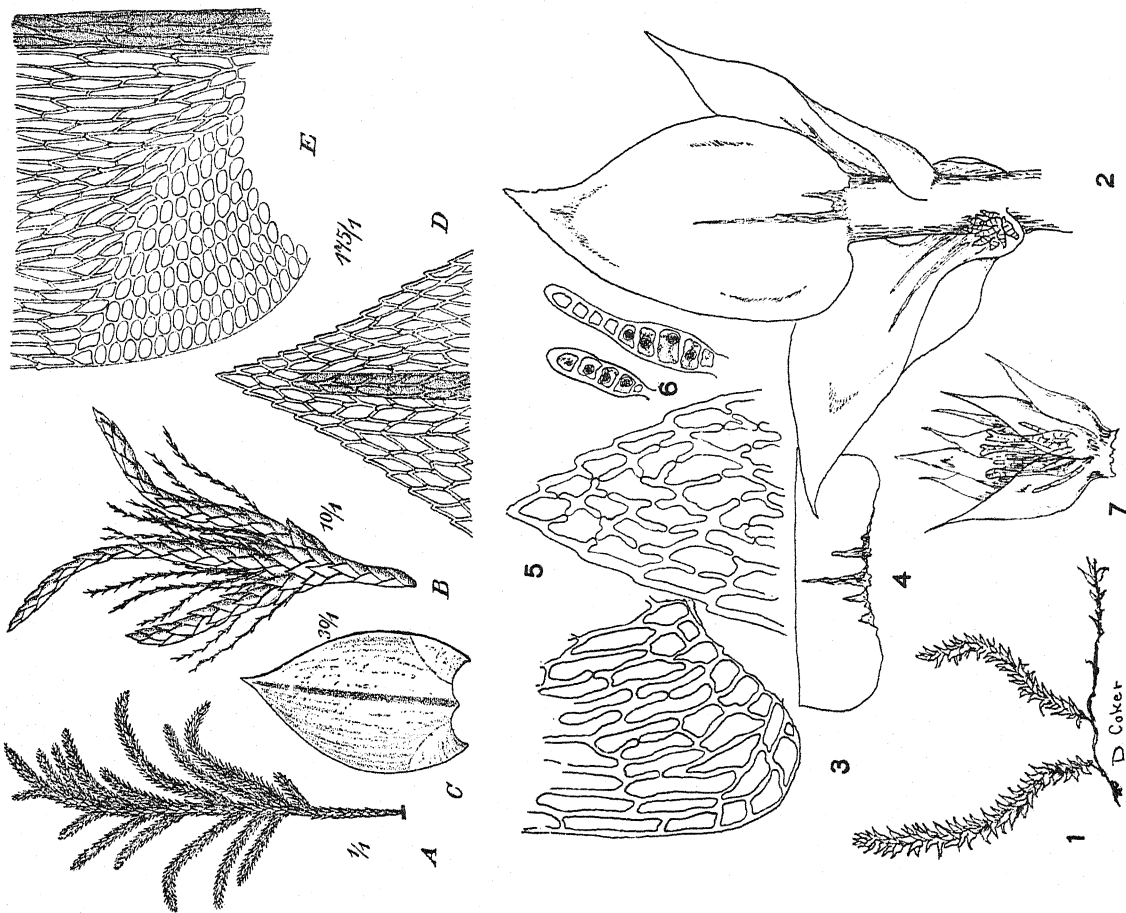
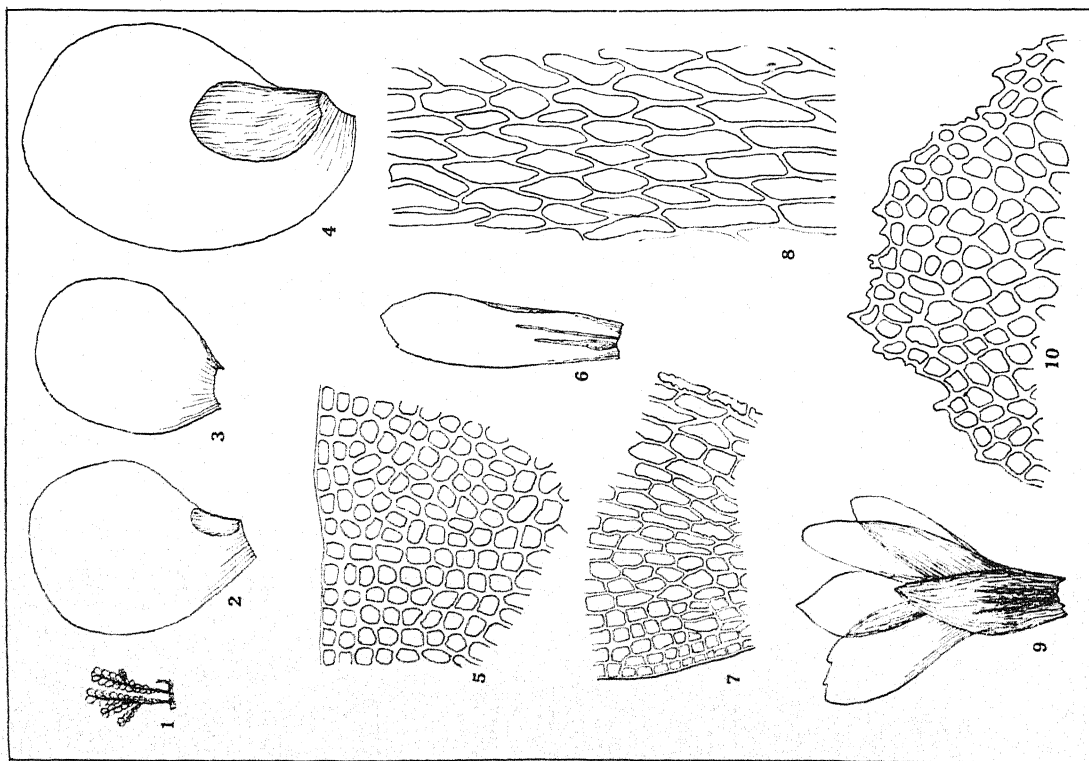


PLATE LXV

PLATE 65. Left, *Homalia Sharpii* (from Bryologist, 34: pl. 2). 1, plant $\times 1$; 2, 3, 4, branch leaves $\times 40$; 5, apical leaf cells $\times 215$; 6, inner perichaetial leaf $\times 40$; 7, basal cells on one side of leaf $\times 215$; 8, median leaf cells $\times 215$; 9, perichaetial leaves $\times 40$; 10, apex of perichaetial leaf $\times 215$.

Upper right, A-E. *Pseudocryphaea flagellifera* [from Engler-Prantl, (Ed. 2) 2: f. 502]. A, sterile plant; B, branchlets with flagella in a dry condition; C, stem leaf; D, leaf apex; E, leaf base.

Lower right, 1-7. *Jagerinopsis squarrosa* (from Bryologist 21: pl. 24). 1, plant $\times 1$; 2, part of stem enlarged showing axillary clusters of propagulae; 3, alar and basal leaf cells; 4, portion of leaf base showing variation in costa; 5, apical cells; 6, two propagulae; 7, archegonial bud.

PLATE 66. Above, *Hypopterygium japonicum* (from Bryologist 17: pl. 9). 1, plant from Coronation Island, Alaska $\times 2$; 2, plant from the island of Yoki, Tosa, Japan. 3, branch from Foster's plant showing the small ventral leaves, amphigastrea.

Below, *Leucodon sciuroides* (from Limpricht, Laubm. 2: f. 330, redrawn for Engler-Prantl). A, plant; B, leaf; C, capsule with calyptra; D, peristome; E, longitudinal section through peristome.

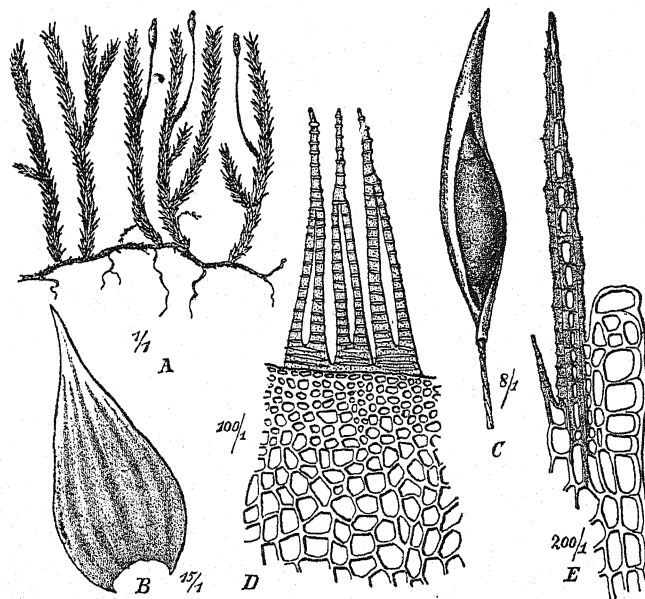
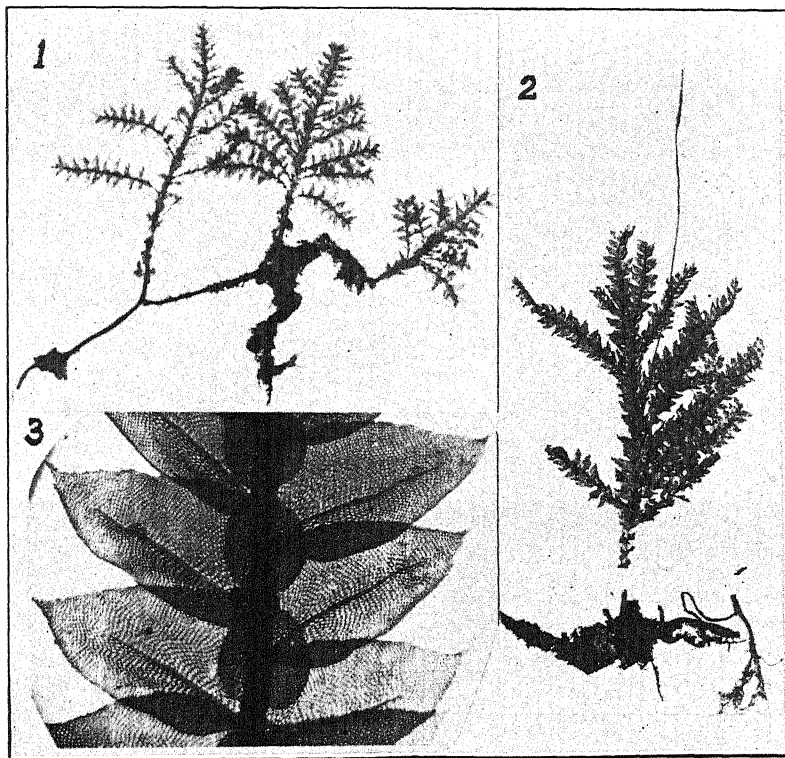


PLATE LXVI.

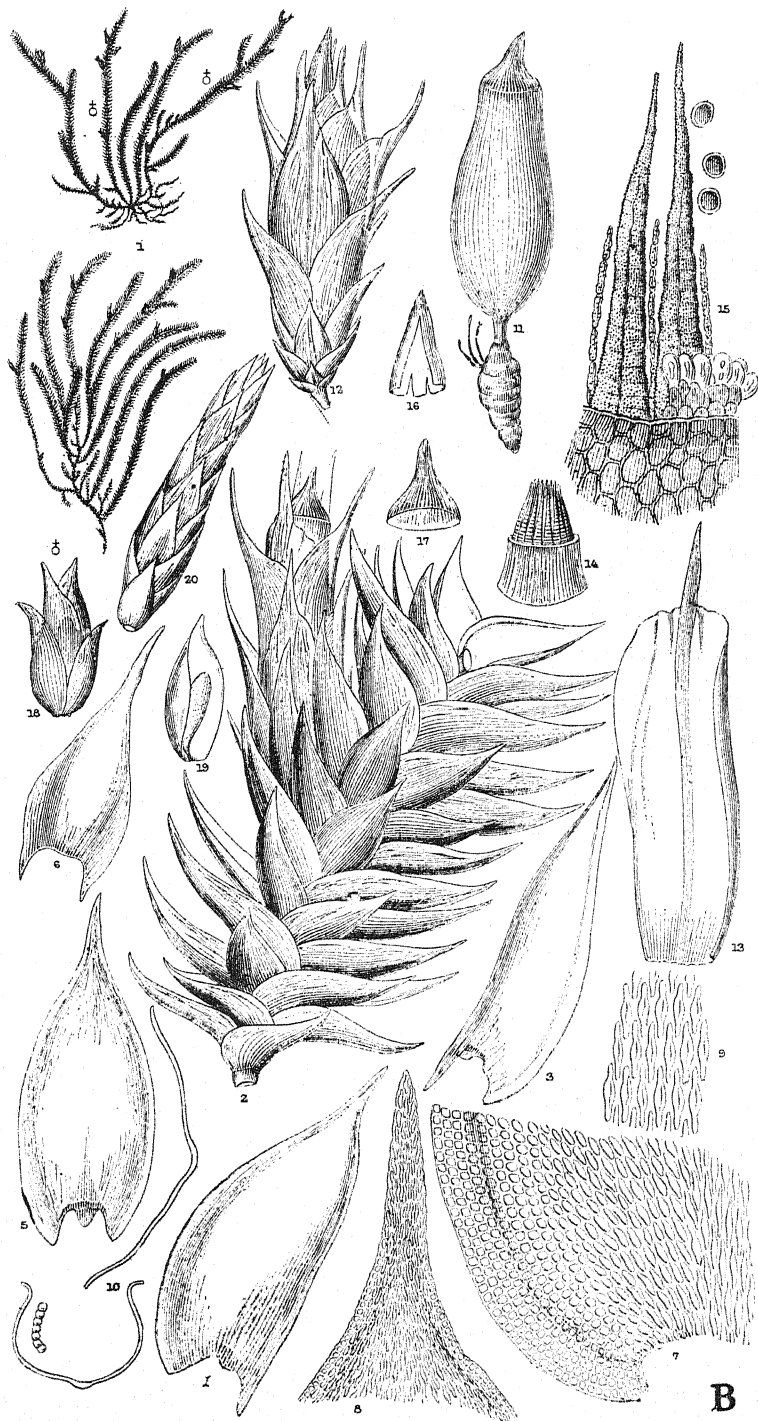
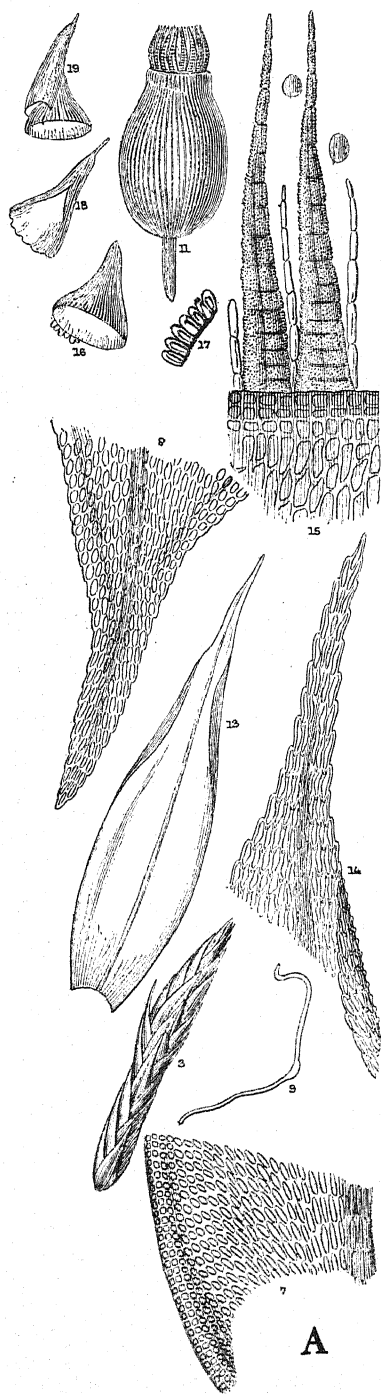


PLATE LXVII.

PLATE 67. A. *Cryphaea nervosa* (from Sull. Icones Musc. pl. 68). 3, part of a dry branch; 7, 8, basal and apical areolation; 9, cross section of leaf; 11, capsule; 13, perichaetial leaf; 14, papillose apex of perichaetial leaf; 15, peristome; 16, operculum; 17, part of annulus; 18, calyptra, 19; operculum and calyptra.

B. *Cryphaea glomerata* (from Sull. l. c. pl. 67). 1, plants $\times 1$; 2, part of a moist fertile branch; 3, 4, 5, 6, leaves (wrongly depicted as ecostate); 7, basal cells; 8, 9, apical cells; 10, cross section of leaf; 11, capsule; 12, perichaetium with included capsule; 13, inner perichaetial leaf; 14, peristome; 15, peristome and annulus; 16, calyptra; 17, operculum; 18, antheridial bud; 19, perigonal leaf with antheridium; 20, part of a dry branch.

PLATE 68. A. *Leptodon ohioensis* (from Sull. Icones Musc. *pl.* 72). 2, part of a secondary stem; 3, 4, 5, leaves; 6, 7, base and apex of leaf; 8, 9, cross sections of leaf; 13, perichaetium and capsule; 14, calyptra; 16, 17, peristome.

B. *Leptodon nitidus* (from Sull. Icones Musc. Suppl. *pl.* 60). 2, part of a leafy stem; 3, leaf; 4, 5, apical and basal cells; 6, perichaetium and capsule; 7, perichaetial leaf; 8, capsule; 9, peristome; 10, germinating spore.

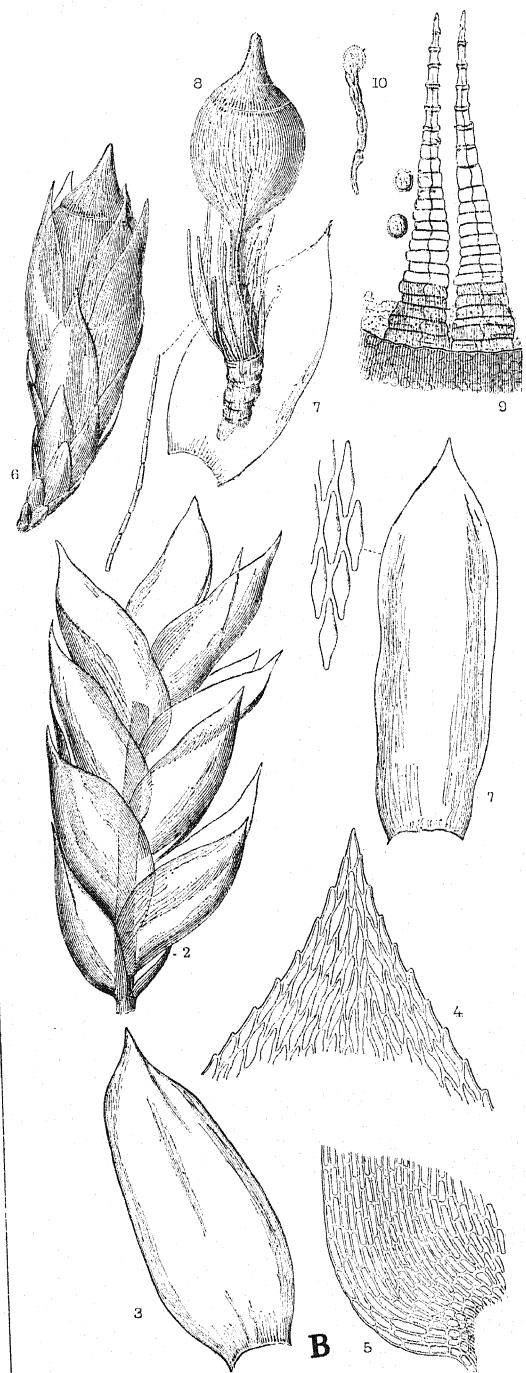
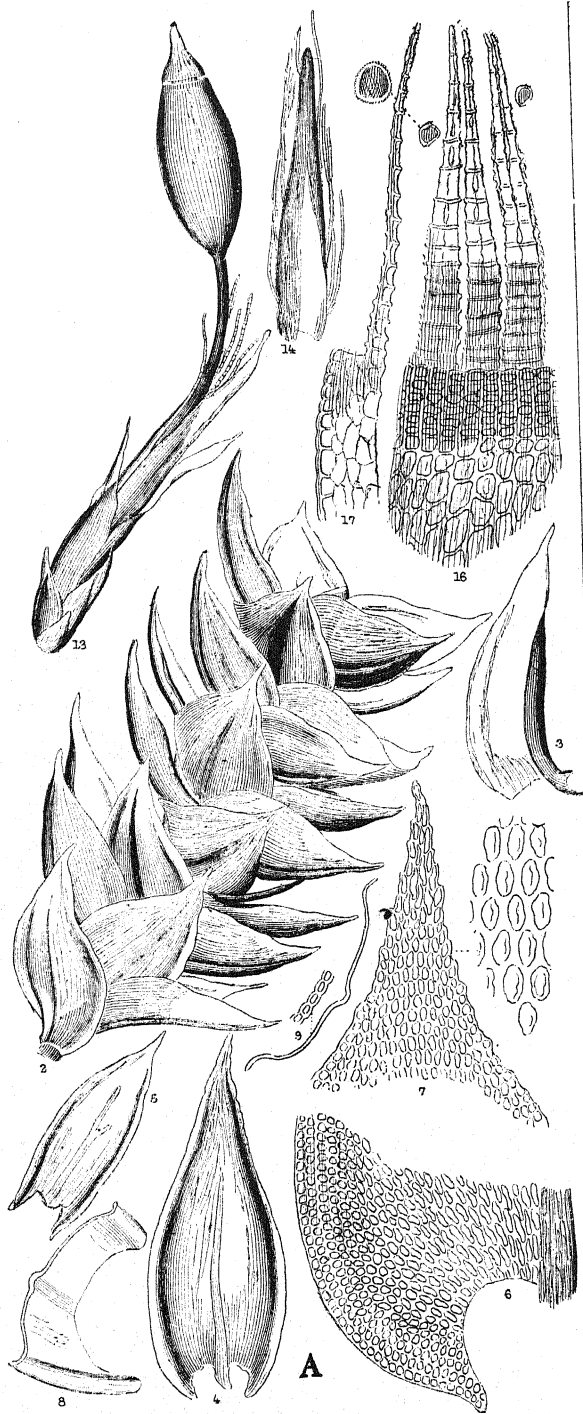


PLATE LXVIII.

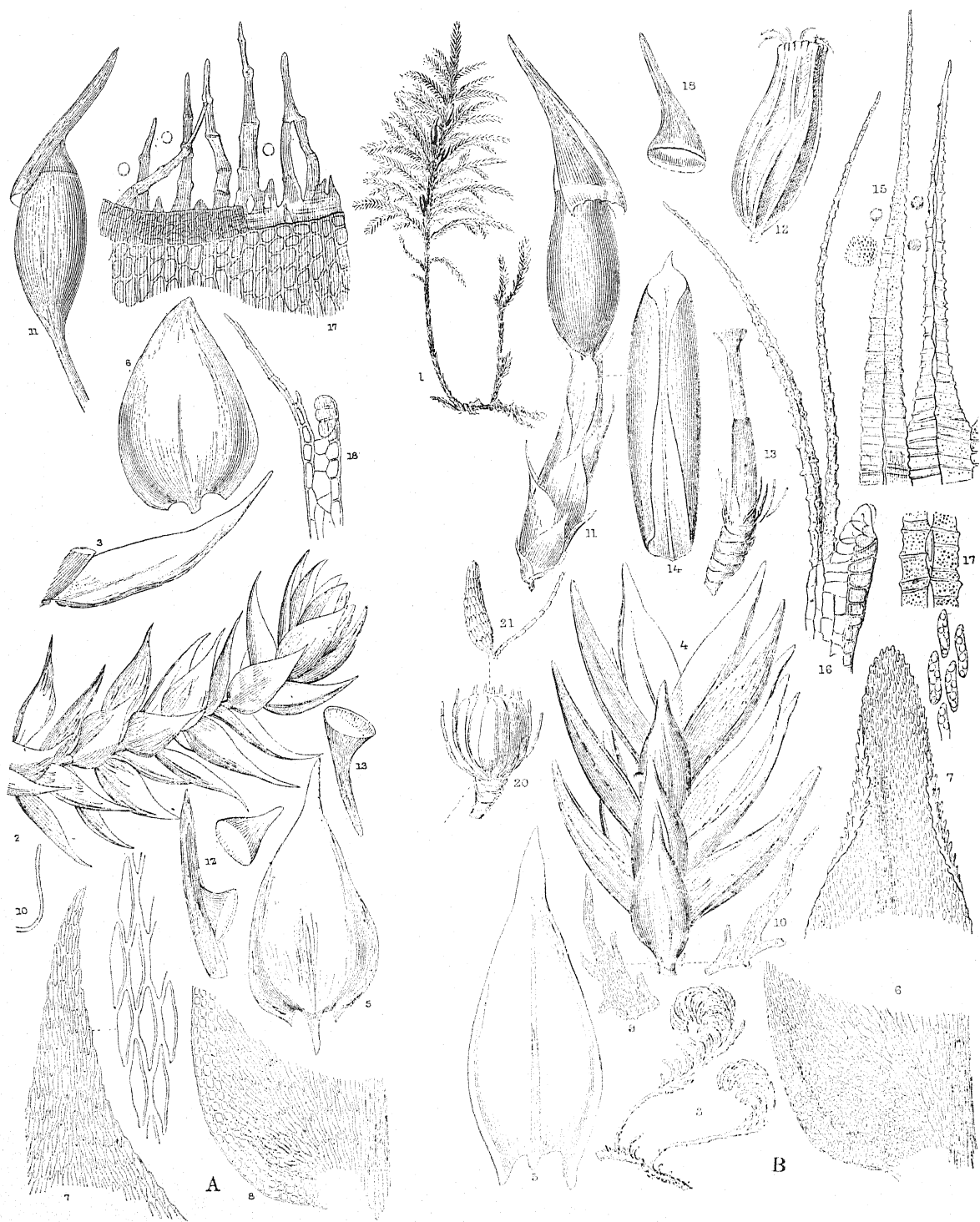


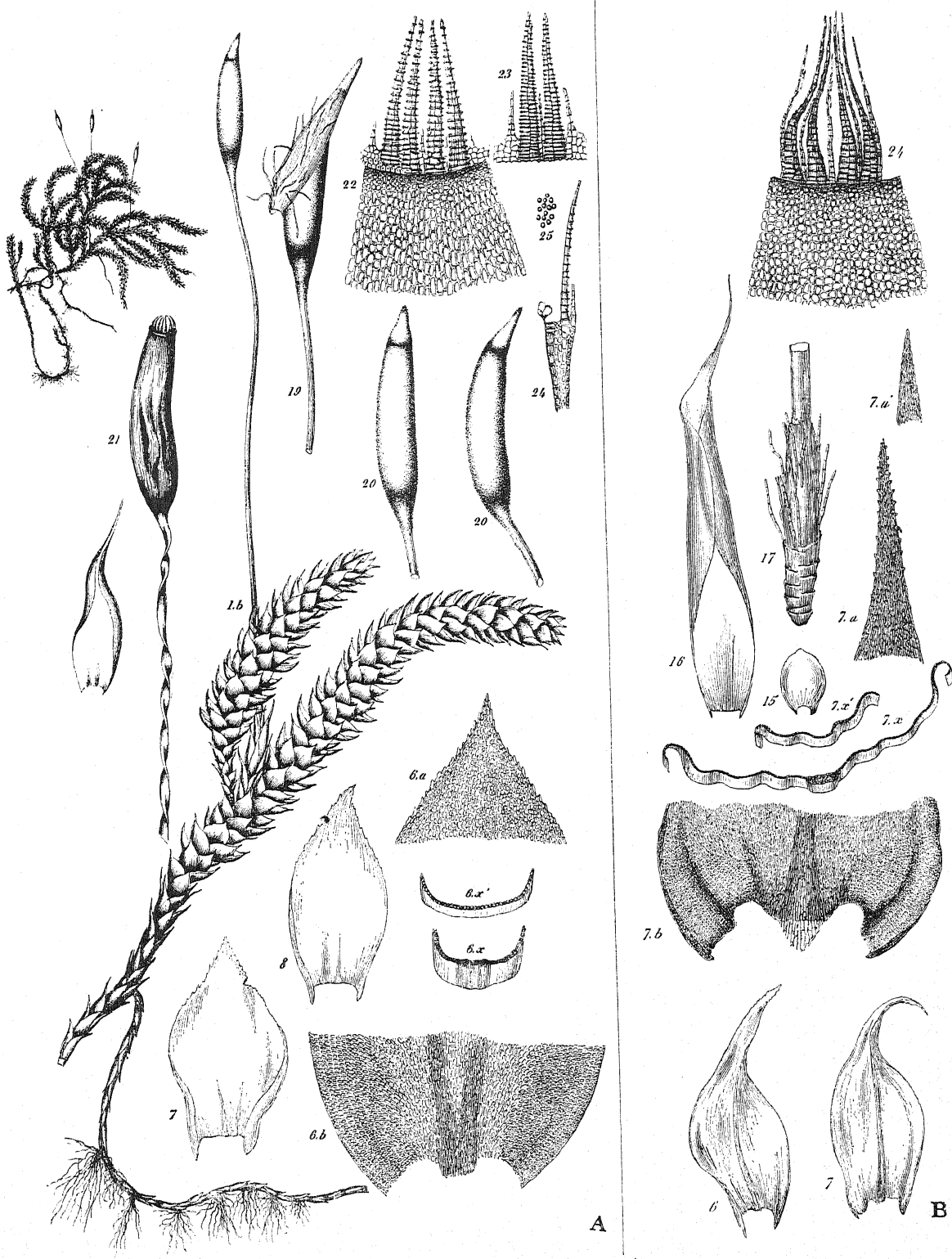
PLATE LXIX.

PLATE 69. A. *Clasmatodon parvulus* (from Sull. Icones Musc. pl. 79). 2, leafy branch; 3, leaf; 5, 6, leaves; 7, 8, apical and basal cells; 10, portion of cross section of leaf; 11, capsule with calyptra; 12, 13, calyptra and opercula; 17, portion of peristome; 18, longitudinal section of peristome.

B. *Dendroalsia abietina* (from Sull. Icones Musc. pl. 72b). 1, plant with capsules; 3, dry plant; 4, part of a branch; 5, branch leaf; 6, 7, basal and apical leaf cells; 9, 10, paraphyllia; 11, perichaetium, capsule and calyptra; 12, dry capsule; 14, inner perichaetial leaf; 15, 16, 17, peristome; 18, operculum; 20, 21, antheridia and paraphyses.

PLATE 70. A. *Pterogonium gracile* (from Bry. Eur. *pl.* 467). 1b, portion of plant enlarged; 6a, 6b, apical and basal leaf cells; 7, 8, leaves; 12, perigonal leaf; 19, 20, 21, capsules; 22, 23, 24, peristome, portions of annulus are shown in 22 and 24.

B. *Antitrichia curtipendula* (from Bry. Eur. *pl.* 469). 6, 7, leaves; 7a, 7b, apex and base of leaves; 7x, cross sections of leaf; 16, perichaetial leaf; 24, peristome.



HYPNACEAE
Pterogonium
PLATE LXX.

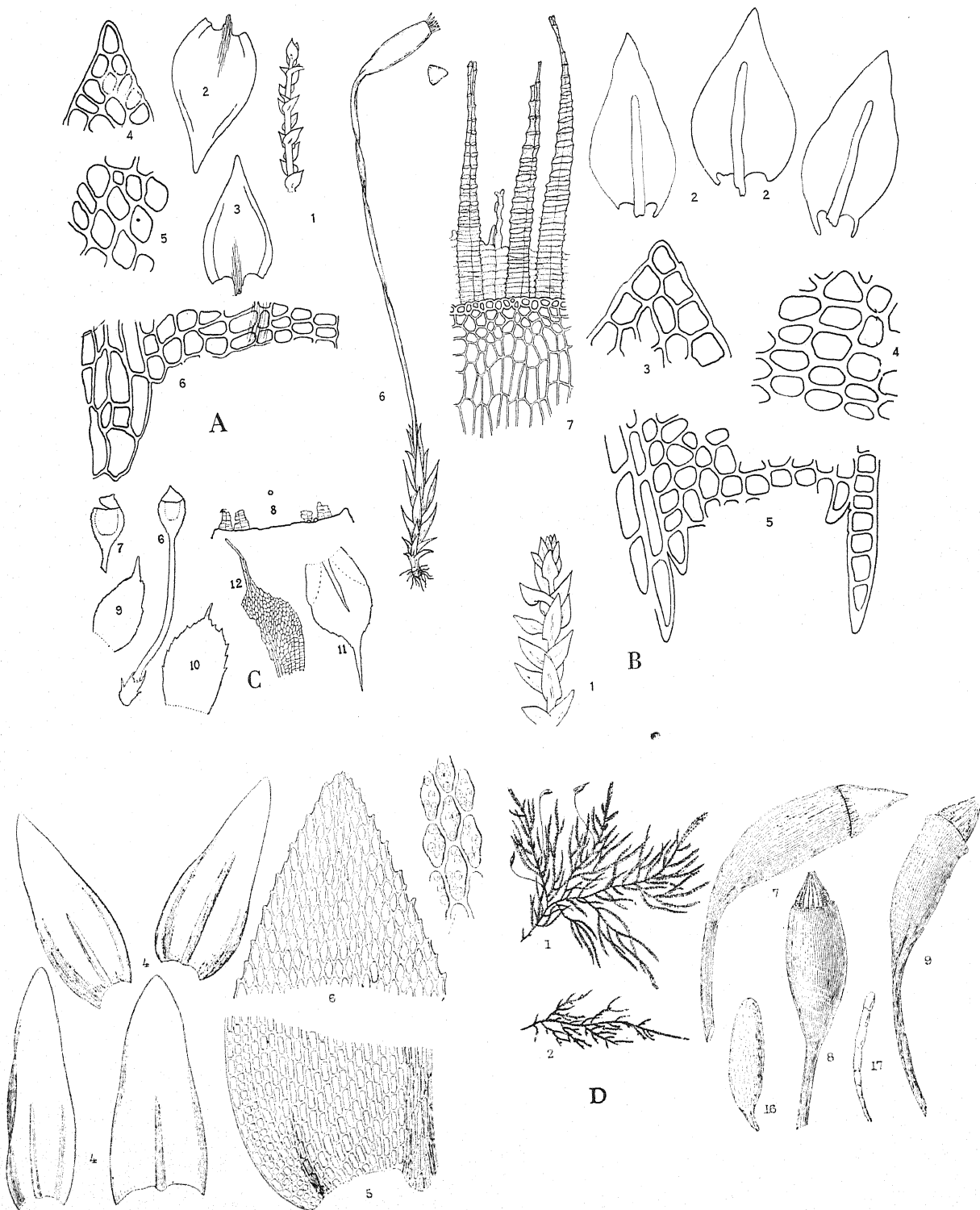


PLATE LXXI.

PLATE 71. A. *Leskea cyrtophylla*. 1, portion of plant $\times 6$; 2, 3, leaves $\times 50$; 4, 5, 6, cells of leaf apex, middle, and base respectively $\times 250$.

B. *Leskea gracilescens*. 1, portion of plant $\times 5$; 2, leaves $\times 30$; 3, 4, 5, cells of leaf apex, middle, and base respectively $\times 450$; 6, sporophyte $\times 10$; 7, part of peristome $\times 125$. (Drawings by A. J. Sharp.).

C. *Fabronia imperfecta* (from Bryologist 36: pl. 1). 6, sporophyte $\times 13$; 7, capsule $\times 13$; 8, peristome $\times 75$; 9, 10, outlines of perichaetial leaves $\times 40$; 11, branch leaf $\times 40$; 12, areolation of branch leaf $\times 40$.

D. *Bestia occidentalis* (from Sull. Icones Suppl. pl. 81). 1, 2, male and female plants $\times 1$; 4, leaves; 5, 6, cells of base and apex; 7, 8, 9, capsules; 16, antheridium; 17, paraphysis.

PLATE 72. A. *Fabronia Wrightii* (from Sull. Icones Musc. pl. 84). 5, 7, leaves; 13, exothecial cells and peristome.

B. *Fabronia gymnostoma* (from Sull. l. c. pl. 86). 1, plants $\times 1$; 7, leaf; 8, median leaf cells; 11, mouth of capsule showing membrane that seems to replace peristome; 16, perichaetial leaf.

C. *Fabronia Ravenelii* (from Sull. l. c. pl. 85); 2, fertile plant enlarged; 6, 7, leaves; 8, median marginal cells; 9, capsules; 11, perichaetial leaf; 13, operculum; 15, calyptra; 16, exothecial cells and part of peristome.

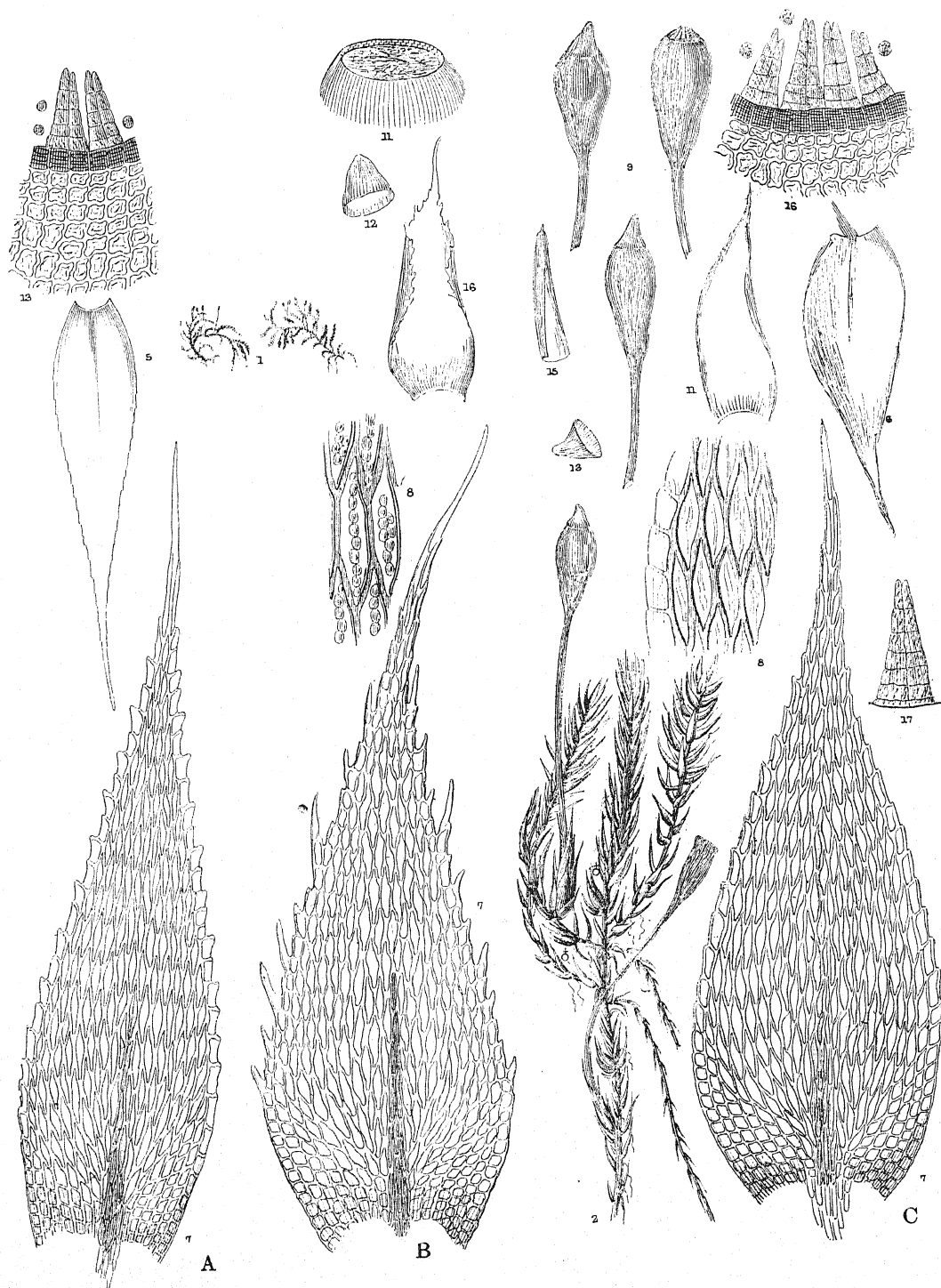


PLATE LXXII.



PLATE LXXIII.

PLATE 73. A. *Fontinalis Kindbergii* (from Bot. Gaz. 15: pl. 9), a, portion of plant; b, stem leaf; c, branch leaf; d, perichaetium and capsule; e, capsule.

B. *Fontinalis neo-mexicana* (from Sull. Icones Musc. Suppl. pl. 57) 3, portion of branch showing tristichous leaves; 4, leaves; 5, cross sections of leaves; 6, basal and apical leaf cells (the alar not particularly distinctive); 7, perichaetial leaves; 8, perichaetium and capsule; 9, capsule and operculum; 10 and 12, peristome; 11, calyptra.

C. *Fontinalis Howellii* (from Bot. Gaz. 13: pl. 18), a, portion of plant; b, b, (at lower right margin) stem leaves $\times 7$; c, branch leaf $\times 16$.

Plate 74. 1-3, *Fontinalis antipyretica* var. *gigantea*. 1, stem leaf $\times 8.5$; 2, apex of same enlarged; 3, alar cells $\times 186$.

4-7, *F. antipyretica* var. *mollis*. 4, stem leaf $\times 8.5$; 5, 6, branch leaves $\times 8.5$; 7, leaf apex enlarged (all from type duplicate).

8-10, *F. antipyretica* var. *oreganensis*. 8, 9, stem leaves $\times 8.5$; 10, leaf apex enlarged.

11-13, *F. antipyretica* var. *patula*. 11, stem leaf $\times 8.5$; 12, 13, leaf apices enlarged.

14-17, *F. antipyretica* (typical, from Bry. Eur., *pl.* 429, redrawn). 14, portion of stem with leaves; 15, leaf $\times 7$; 16, perichaetium and capsule; 17, peristome.

18-22, *Fontinalis chrysophylla*. 18, stem leaf $\times 8$; 19, apex of stem leaf $\times 314$; 20, alar cells of the same $\times 162$; 21, branch leaf $\times 8.5$; 22, apex of branch leaf $\times 278$.

23, 24, *Fontinalis neo-mexicana*. 23, stem leaf $\times 8.5$; 24, leaf apex enlarged (see also *pl.* 73).

25-30, *Fontinalis Sullivanti*. 25, stem leaf $\times 8.5$; 26, apices of stem leaves $\times 57$; 27, branch leaf $\times 8.5$; 28, apices of branch leaves $\times 57$; 29, alar cells of branch leaf $\times 255$; 30, perichaetial leaf $\times 8.5$ (1-8 from Austin Musc. Appal. 249, 9 from Grout, Musc. Pl. 73).

31-36, *F. Sullivanti* var. *microdonta*. 31, stem leaf $\times 8.5$; 32, apex of stem leaf $\times 57$; 33, portion of branch with leaves $\times 8.5$; 34, apex of branch leaf $\times 57$; 35, alar cells of stem leaf; 36, perichaetium and capsule $\times 8.5$ (from specimen in Renauld herbarium at Harvard; coll. Lesq. in 1883).

(All drawings by William Gray.)

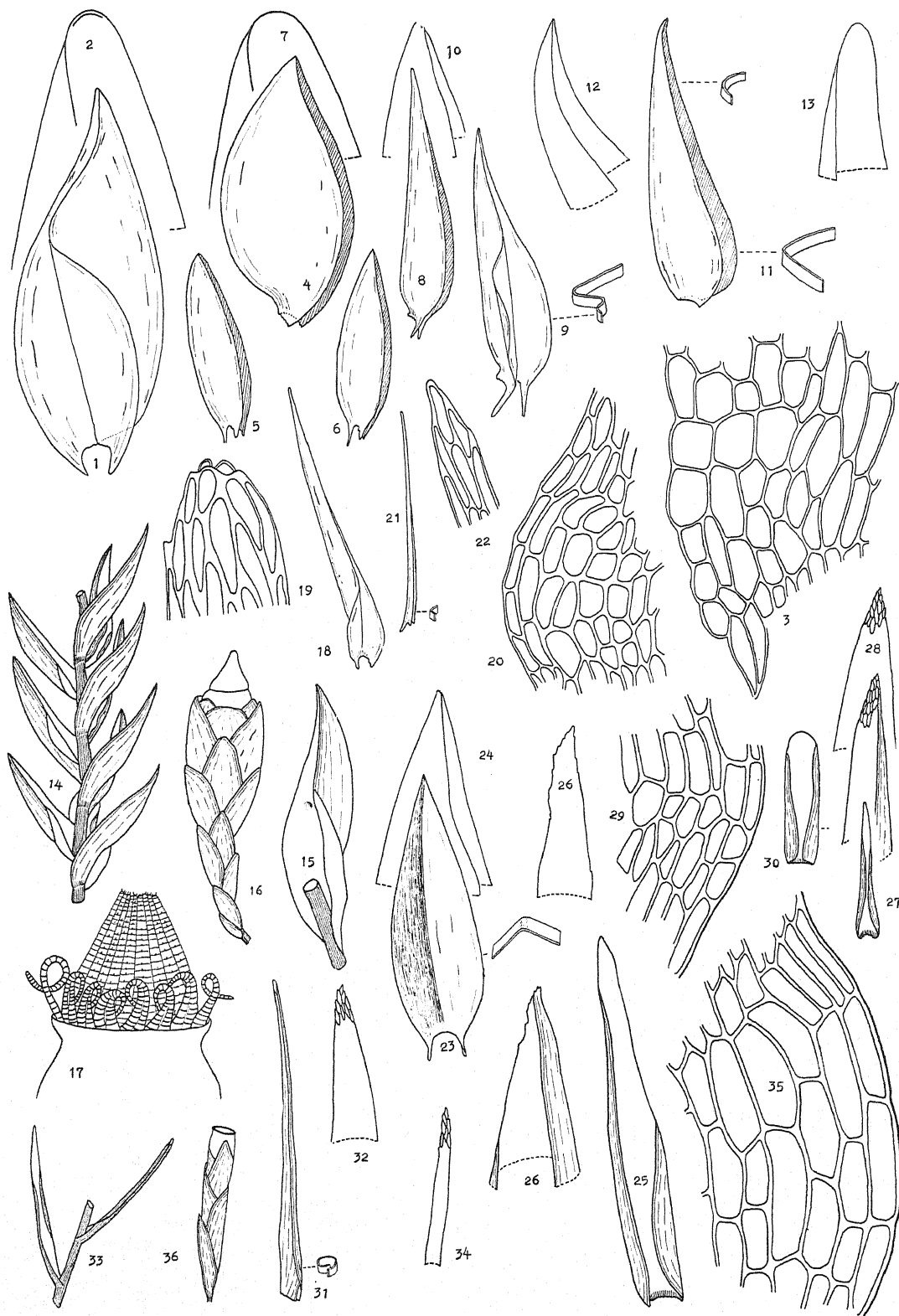


PLATE LXXIV.

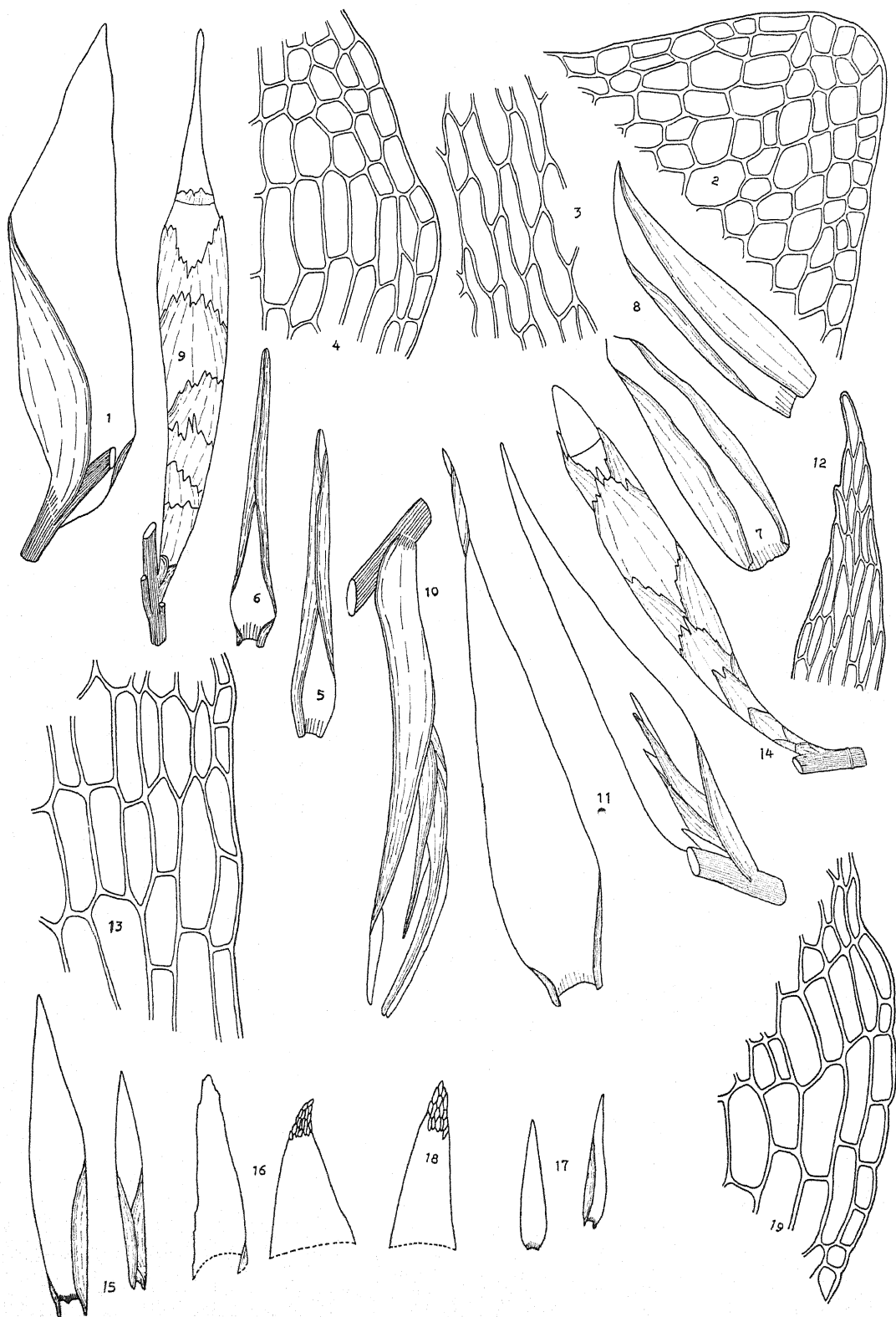


PLATE LXXV.

PLATE 75. 1-9, *Fontinalis biformis*. 1, leaf of young (vernal) plant; 2, apical cells of same $\times 255$; 3, median cells of same $\times 255$; 4, alar cells $\times 255$ (inverted); 5, 6, adult (aestival) leaves; 7, 8, perichaetial leaves; 9, calyptra, operculum and capsule in old perichaetial leaves [2-4 from Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 337]; the others redrawn from Sull. Icones Musc. plates 59 & 60).

10-14, *Fontinalis disticha*. 10, portion of branch with leaves; 11, stem leaves; 12, leaf apex $\times 255$; 13, alar cells $\times 255$; 14, capsule and operculum in perichaetial leaves [12, 13 from Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 227; the others redrawn from Sull. Icones Musc. pl. 63].

15-19, *Fontinalis missourica*. 15, stem leaves $\times 8.5$; 16, apices of stem leaves $\times 57$; 17, branch leaves $\times 8.5$; 18, apex of branch leaf; 19, alar cells of stem leaf $\times 255$ (drawn from *Demetrio*, 3810, near Cole Camp Creek, Benton Co., Missouri).

(By William Gray)

PLATE 76. 1-2, *Fontinalis Novae-Angliae* var. *latifolia*. 1, leaf $\times 8.5$; 2, leaf apices $\times 59$ (drawn from type or type duplicate).

3-6, *F. Novae-Angliae* var. *heterophylla*. 3, stem leaf $\times 8.5$; 4, apex of same $\times 59$; 5, branch leaf $\times 8.5$; 6, apices of branch leaves $\times 59$ (drawn from type or type duplicate).

7-10, *Fontinalis dalecarlica*. 7, portion of stem showing arrangement and form of the leaves; 8, leaf showing involute margins; 9, leaf apices enlarged; 10, perichaetium and capsule (7, 8, 10 from Bry. Eur. pl. 431).

11-15, *Fontinalis Allenii*. 11, leaf concave below and keeled above $\times 8.5$; 12, leaf concave at base and plane above $\times 8.5$; 13, 14, 15, leaf apices, carinate plane and concave $\times 56.8$ (drawn from type or duplicate type). See pl. 78.

16-19 omitted.

20-23, *Fontinalis Novae-Angliae*. 20, perichaetium and capsule; 21, perichaetial leaf; 22, leaves $\times 8.5$; 23, leaf apices enlarged (20, 21 from Sull. Icones Musc. Pl. 65).

24-25, *F. Novae-Angliae* var. *Lorenziae*. 24, leaf $\times 8.5$; 25, leaf apices $\times 59$ (drawn from type or type duplicate).

26-28, *F. Novae-Angliae* var. *involuta*. 26, leaf with narrowly involute margins; 27, leaf with broadly involute margins, both $\times 8.5$; 28, leaf apex $\times 59$.

29-30, *F. Novae-Angliae* var. *Delamarei*. 29, leaves $\times 8.5$; 30, leaf apices $\times 59$ (from type or type duplicate).

31-32, *F. Novae-Angliae* var. *Waghornei*. 31, leaf $\times 8.5$; 32, leaf apices $\times 59$ (from type or type duplicate).

(All by William Gray)

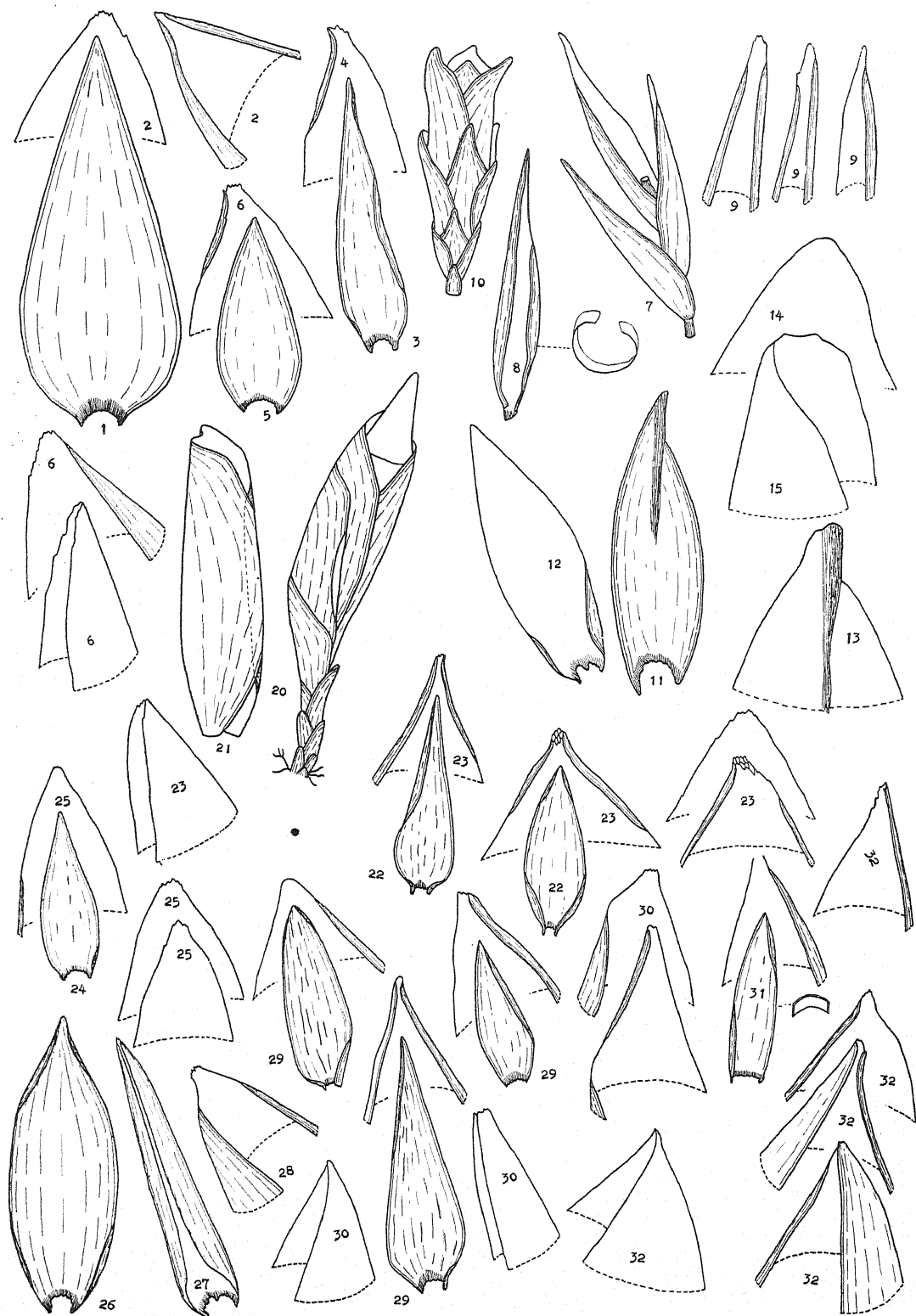


PLATE LXXVI.

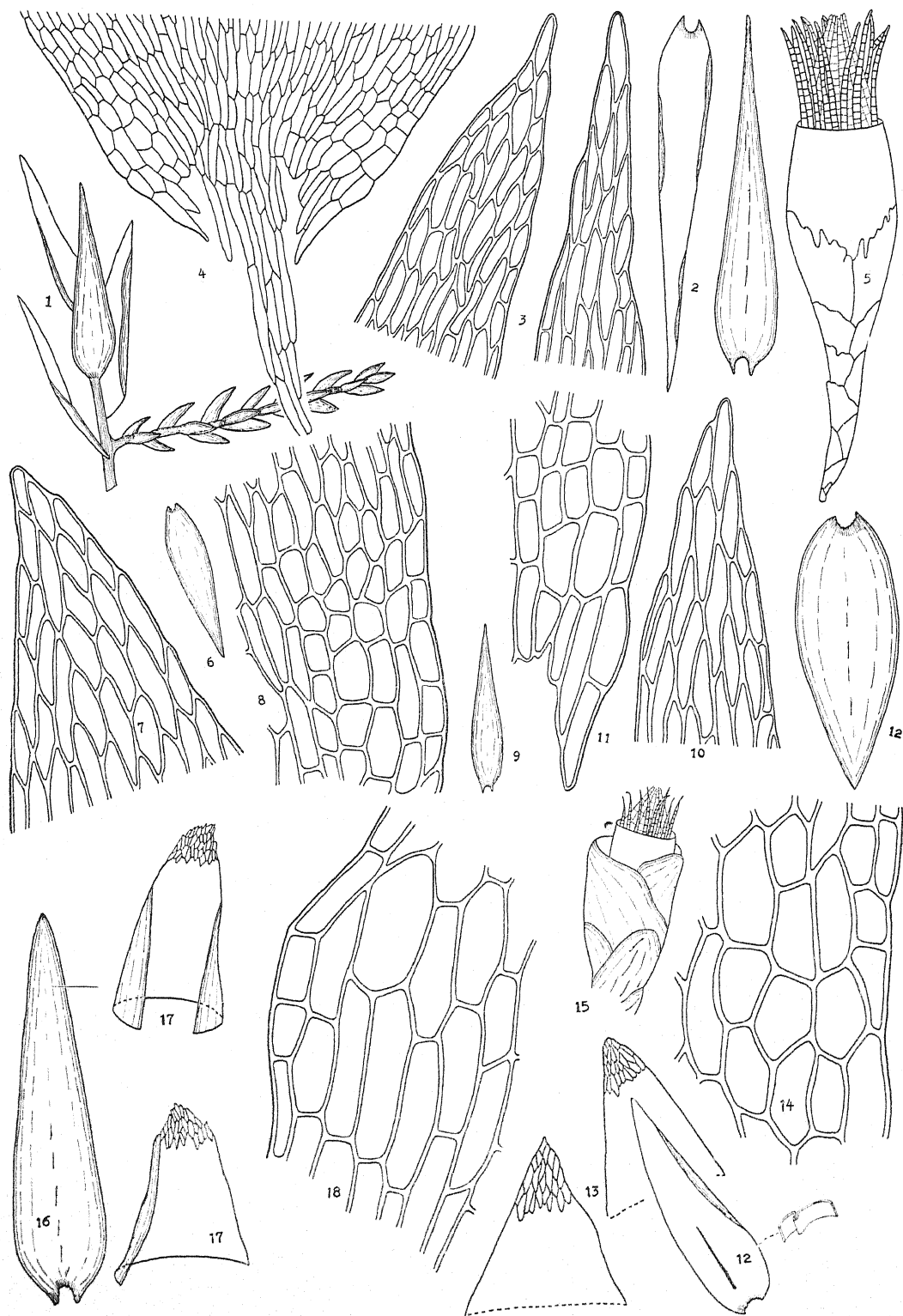


PLATE LXXVII.

PLATE 77. 1-5, *Fontinalis hypnoides*. 1, portion of stem with branch; 2, stem leaves; 3, apices of median leaves on the same branch $\times 255$; 4, leaf base $\times 150$; 5, mature capsule and perichaetium (1, 2 and 5, redrawn from Bry. Eur. *pl.* 432; 3 and 4 from *Leiberg*, W. Am. Mosses, 137).

6-8, *Fontinalis nitida*. 6, base of stem leaf $\times 8.5$; 7, leaf apex $\times 255$; 8, alar cells $\times 255$ (drawn from *Grout*, N. Am. Musc., Pl. 297).

9-11, *Fontinalis tenella*. 9, leaf $\times 8.5$; 10, leaf apex $\times 255$; 11, alar cells $\times 255$ (drawn from type duplicate).

12-15, *Fontinalis Duriaei*. 12, 12, stem leaves $\times 8.5$; 13, leaf apices $\times 57$; 14, alar cells $\times 255$; 15, perichaetium and capsule (12-14 from *Holzinger*, Mosses N. E. Minnesota, Rosebush Falls, 7-28-1902; 15 from *Husnot*, Musc. Gall. *pl.* 81).

16-18, *Fontinalis denticulata*. 16, stem leaf $\times 8.5$; 17, leaf apices $\times 57$; 18, alar cells $\times 255$ (drawn from a supposed type duplicate).

PLATE 78. 1-5, *Fontinalis Lescurii*. 1, stem leaf; 2, alar cells $\times 170$; 3, perichaetium with capsule completely immersed; 4, perichaetial leaf; 5, portion of peristome (2 from *Nichols*, Conn. 4-14-1911, the rest redrawn from Sull. *Icones Musc. pl. 61*).

6-10, *F. Lescurii* var. *ramosior*. 6, stem leaf; 7, leaf apices $\times 170$; 8, perichaetium and capsule; 9, perichaetial leaf; 10, portion of peristome (7 drawn from Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 224c*, the others redrawn from Sull. *Icones Musc. pl. 62*).

11, alar cells of *F. Allenii* $\times 170$.

a-d, *Fontinalis flaccida*. b-b', leaf apices, b'b' $\times 38$; aa. leaves; c, alar cells; d, median cells (b', from duplicate type, the others reproduced from Bot. Gaz. 13: *pl. 19*).

(All drawings except a, d by William Gray.)

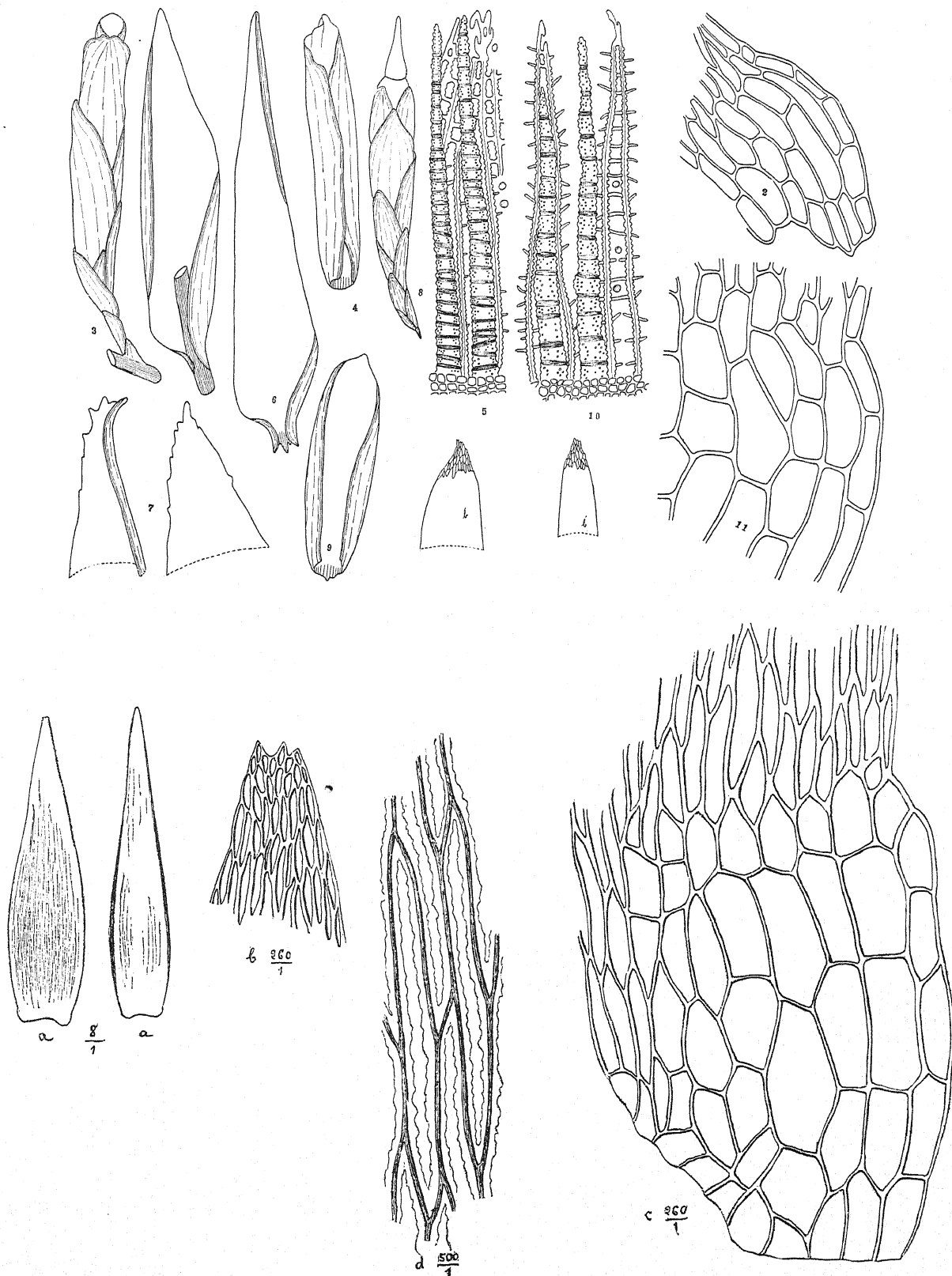


PLATE LXXVIII.

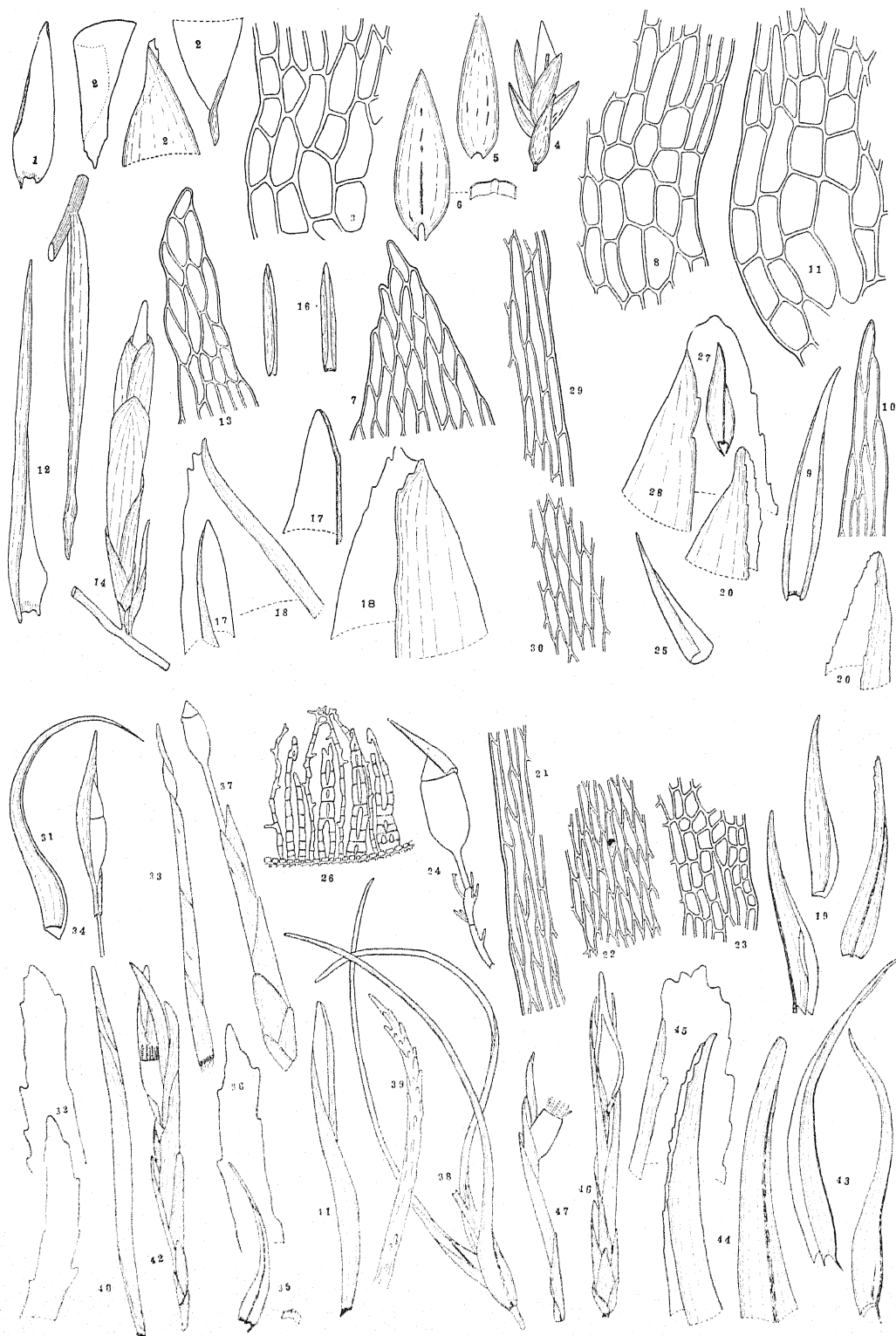


PLATE LXXIX.

PLATE 79. 1-3, *Fontinalis MacMillani*. 1, leaf $\times 6$; 2, leaf apices $\times 38$; 3, alar cells $\times 170$.

4-8, *Fontinalis subcarinata*. 4, portion of stem, showing 4-ranked leaves; 5, plane stem leaf $\times 6$; 6, subcarinate stem leaf $\times 6$; 7, apex of stem leaf $\times 170$; 8, alar cells $\times 170$ (4, redrawn from Bot. Gaz. 37: pl. 23, f. 2b; 5-8, from Macoun, 264, Assiniboia, Canada).

9-11, *Fontinalis dichelymoides*. 9, stem leaf $\times 15$; 10, leaf apex $\times 170$; 11, alar cells $\times 170$ (9, redrawn from Engler & Prantl (Ed. 2) 11: f. 476; 10, from specimen from Vermilion Lake, Minn. July 21, 1886, Arthur; 11, from specimen from Lake Pijärvi, Finland, Aug. 7, 1896, Brotherus).

12-14, *Fontinalis filiformis*. 12, stem leaves; 13, leaf apex $\times 170$; 14, perichaetium and capsule; (13 from a specimen collected in southern Kentucky by Lesq., in herb. Austin; others from Sull. Icones Musc. pl. 64).

16-18, *Fontinalis Langloisii*. 16, stem leaves $\times 6$; 17, leaf apices $\times 38$; 18, leaf apices $\times 170$ (from Langlois, Flora Ludoviciana 648).

19-26, *Brachelyma subulatum*. 19, stem leaves; 20, leaf apices $\times 38$; 21, marginal leaf cells $\times 170$; 22, median leaf cells $\times 170$; 23, alar cells $\times 170$; 24, seta, capsule, operculum and calyptra; 25, perichaetial leaf; 26, outer and inner peristome (20-23 from Small, Georgia Mosses, 5079; the others from Bry. Eur. pl. 434).

27-30, *Brachelyma robustum*. 27, stem leaf $\times 6$; 28, leaf apex $\times 170$; 29, marginal leaf cells $\times 170$; 30, median leaf cells $\times 170$ (from Harper, Georgia Plants 1919a).

31-34, *Dichelyma falcatum*. 31, stem leaf; 32, leaf apices $\times 170$; 33, inner perichaetial leaf; 34, seta, capsule, and dimidiate clasping calyptra. (32 from Grout, Musci Pl. 396; the others from Bry. Eur. pl. 433).

35-37, *Dichelyma uncinatum*. 35, stem leaf $\times 6$; 36, leaf apex $\times 170$; 37, perichaetium, seta, and capsule (after Mitten, Journ. Linn. Soc. 8: pl. 8; 35 & 36 from Lyall, Oregon Boundary Commission, 1861).

38-42, *Dichelyma capillaceum*. 38, portion of stem with leaves; 39, leaf apex; 40-41, perichaetial leaves; 42, perichaetium and capsule (from Bry. Eur. pl. 436).

43-47, *Dichelyma pallescens*. 43, stem leaves; 44, leaf apices $\times 38$; 45, leaf apex $\times 170$; 46, perichaetium, capsule, and calyptra; 47, perichaetium and laterally emergent capsule (42-45 from Austin, Musc. Appal. Suppl. 525; others from Bry. Eur. pl. 525).

(All drawings on this plate made by William Gray)

PLATE 80. Left, *Sciaromium Fryei* (from the Bryologist 35: pl. 5). 1, plant $\times 1$; 2, portion of cross-section of stem $\times 200$; 3, stem leaf $\times 15$; 4, upper branch leaf $\times 15$; 5, cross-section of leaf $\times 120$; 6, border cells well down leaf $\times 160$; 7, basal leaf angle $\times 160$; 8, median cells and border $\times 160$.

Upper right, *Rhynchostegiella georgiana* (from Bryologist 33: pl. 4). 1, portion of fruiting plant dry; 2, portion of same moist; 3, leaves; 4, apical cells; 5, cells of basal angles.

Lower right, *Hygroamblystegium macroneuron* (from Bryologist 36: f. 1). 1, plant $\times 1.5$; 2, 3, leaves (too blunt at apex); 4, leaf apex $\times 350$; 5, median leaf cells $\times 350$.

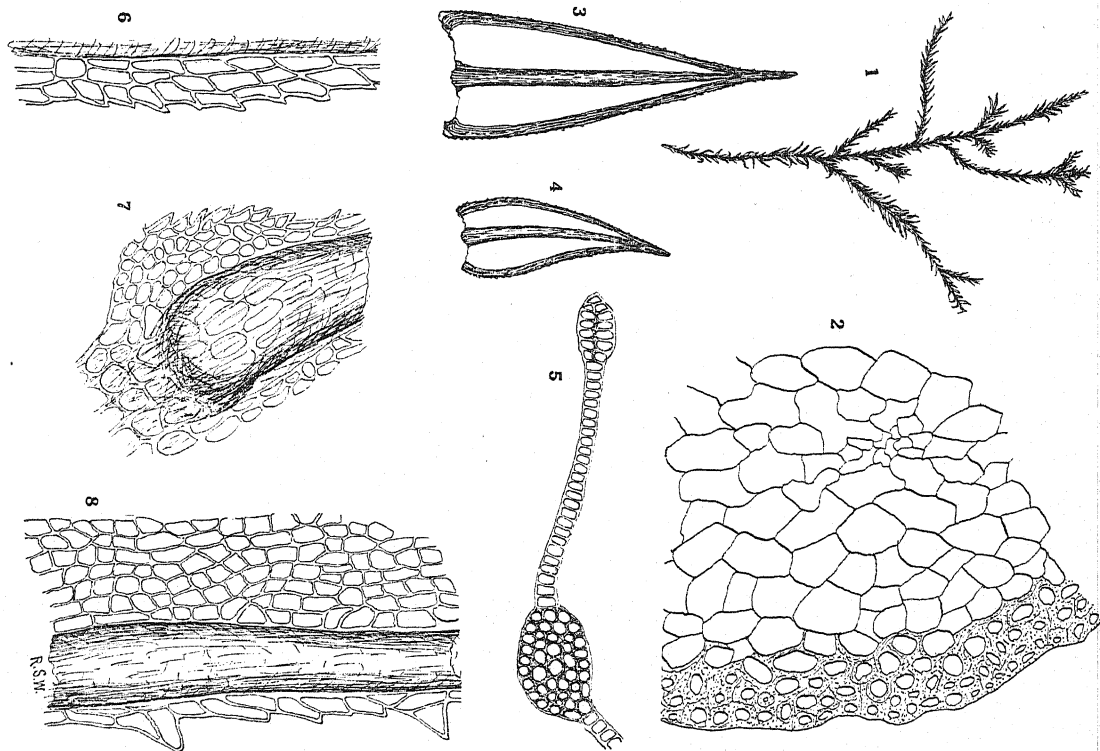


PLATE LXXX.

